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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 42 JULY 1945 NUMBER 1

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PENICILLIN IN THE TREATMENT OF PATIENTS WITH DEEP INFECTIONS OF THE NECK

LIEUTENANT COLONEL THOMAS R. GAINES AND MAJOR MILFORD B. HATCHER
MEDICAL CORPS, ARMY OF THE UNITED STATES

A review of available literature [1] disclosed no reference to the use of penicillin in the treatment of patients with infections involving the fascial compartments of the neck. Many writers have described the cervical fascial layers, their attachments, the spaces formed, the intercommunications of these and, finally, their communication with the mediastinum by means of so-called fascial planes.[2] Suffice it to say that the most frequent locations for the collection of infection, and those of most interest to the surgeon, are (1) the retropharyngeal space, (2) the lateral pharyngeal, parapharyngeal or pharyngomaxillary space and (3) the submandibular space. All these spaces in the normal state are potential; they become distended only under pathologic conditions.

The retropharyngeal space lies posterior to the pharynx, between the posterior pharyngeal wall and the prevertebral fascia. Simple abscesses occur here most frequently in infancy and early childhood, the focus of infection usually being in the pharynx or the nasopharynx. The abscess is usually unilateral and is located just behind and below the soft palate. There are fever, restlessness, refusal to take nourishment and change of voice. The mouth is usually held open. There may be enlargement of posterior cervical glands. A fluctuant mass can usually be made out on the posterior or lateral pharyngeal wall. Treatment consists in draining the abscess surgically through the mouth, with the patient's head down, and using suction to remove the pus and prevent its aspiration. The chronic type of retropharyngeal abscess is usually due to tuberculous disease of the cervical vertebrae, and its treatment is that of the tuberculous process.

The pharyngomaxillary space, 1½ inches (3.5 cm.) in length, is situated lateral to the pharynx, is conical in shape with a base approximately 1 inch (2.5 cm.) in diameter, which is directed upward against the base of the skull at the jugular foramen. The apex is downward and is at the greater cornu of the hyoid bone. The boundaries are as follows: internally, the lateral pharyngeal wall, including the superior constrictor pharyngeal muscle; externally, the ramus of the mandible and a portion of the capsule of the parotid gland; anteriorly, the internal pterygoid muscle, and posteriorly, the prevertebral muscles and fascia. Within the space is the carotid sheath (containing the carotid arteries, the jugular vein and the vagus nerve), the styloid process with its attachments, the ninth and twelfth cranial nerves,

1. (*a*) Bennett, J. H.: Anesthetic Management for Drainage of Abscess of the Submandibular Space (Ludwig's Angina), Anesthesiology **4**:25-30 (Jan.) 1943. (*b*) Berlin, J. I.: Ludwig's Angina, South. Surgeon **10**:289-297 (April) 1941. (*c*) Conway, J. F.: Chemotherapy in the Management of Ludwig's Angina, J. A. M. A. **118**:953-955 (March 21) 1942. (*d*) Dorrance, G. M.: Acute Infections of the Soft Tissues of the Neck, S. Clin. North America **17**:1797-1808 (Dec.) 1937. (*e*) Endicott, C. L.; Mitchell, J. H., and Qvist, G.: Asphyxia Following Dental Extraction in Haemophiliac, with Notes on Spread of Infection in Ludwig's Angina, Brit. M. J. **2**:34-35 (July 11) 1942. (*f*) Fulghum, J. E.: Sulfanilamide Treatment of Ludwig's Angina, U. S. Nav. M. Bull. **36**:58-59 (Jan.) 1938. (*g*) Grodinsky, M.: Ludwig's Angina, Retropharyngeal Abscess and Other Deep Abscesses of the Head and Neck, J. A. M. A. **114**:18-22 (Jan. 6) 1940; (*h*) Ludwig's Angina: An Anatomical and Clinical Study with Review of the Literature, Surgery **7**:678-696 (May) 1939. (*i*) Iglauer, S.: Acute Suppuration in the Spaces of the Neck, J. Michigan M. Soc. **41**:936-942 (Nov.) 1942. (*j*) Hendricks, W. G.: Surgery or Sulfanilamide in Ludwig's Angina? M. Rec. **150**:415-416 (Dec. 20) 1939. (*k*) Leonardo, R. A.: Ludwig's Angina: Review of Twenty-One Cases, J. Internat. Coll. Surgeons **3**:82-86 (Feb.) 1940. (*l*) McCaskey, C. H.: Ludwig's Angina, Ann. Otol., Rhin. & Laryng. **51**:855-861 (Sept.) 1942; (*m*) Arch. Otolaryng. **36**:467-472 (Oct.) 1942. (*n*) Taffel, M., and Harvey, S. C.: Ludwig's Angina: An Analysis of Forty-Five Cases, Surgery **11**:841-850 (June) 1942. (*o*) Trout, H. H.: Ludwig's Angina, Arch. Surg. **41**:532-541 (Aug.) 1940. (*p*) Tschiassny, K.: Ludwig's Angina: An Anatomic Study of the Role of the Lower Molar Teeth in Its Pathogenesis, Arch. Otolaryng. **38**:485-496 (Nov.) 1943. (*q*) Williams, A. C.: Ludwig's Angina, Surg., Gynec. & Obst. **70**:140-149 (Feb.) 1940. (*r*) Williams, A. C., and Guralnick, W. C.: The Diagnosis and Treatment of Ludwig's Angina: A Report of Twenty Cases, New England J. Med. **228**:443-450 (April 8) 1943.

2. Grodinsky,[1g, h] Leonardo,[1k] Taffel and Harvey,[1n] Trout.[1o]

and the cervical sympathetic trunk, including the superior cervical ganglion. The seriousness of infection in proximity to such vital structures is readily appreciated. Instances of thrombosis of the jugular vein, erosion of the carotid artery, thrombosis of the cavernous sinus, mediastinitis and generalized septicemia are all too often reported. With these facts in mind, it is not difficult to understand why in the literature the mortality rates have ranged as high as 40 per cent.

Infections in this space most often originate in the tonsils, the pharynx or the nasopharynx, less frequently by extension from the submandibular space, from the middle ear or the mastoid process. No doubt, an infection of this space following tonsillectomy is due in many cases to the entrance of the anesthetic needle into the parapharyngeal space through the superior constrictor muscle. In addition to direct spread by contiguity, it is possible the infection may gain entrance from the pharynx and other structures through the lymphatics or along the blood vessels.

The symptoms are definite: There is an indurated, woody, tender, nonfluctuant swelling in the side of the neck, most marked just back of the angle of the jaw; the tonsil and peritonsillar tissues are moderately displaced toward the midline of the pharynx; the skin has an ashy color; the patient looks septic; the general appearance is one of abject misery, the head and neck being held rigid without turning; the mouth opens only slightly, even with extreme effort; there are severe dysphagia and resultant dehydration and malnutrition, marked trismus, dysphonia, fever and leukocytosis (leukopenia has been reported); occasionally there is respiratory embarrassment from laryngeal edema. The causative organism has been variously found to be the streptococcus, the staphylococcus, the pneumococcus, the colon bacillus and Vincent's organism. The streptococcus is thought to be the most frequently observed etiologic agent. In the cases reported the condition has occurred from early childhood to advanced age, the persons most frequently affected being young adults. Most authorities state that males are more susceptible than females.

The treatment has been generally agreed on as primarily a surgical procedure in conjunction with chemotherapy and supportive measures. The most commonly accepted surgical procedure is that of incision along the anterior border of the sternomastoid muscle, with another incision below, medial and parallel to the inner surface of the mandible, the two being joined to form a T (Mosher incision). Blunt dissection with a hemostat in the area of greatest swelling usually is followed by escape of pus. A drain of some type is used to keep the wound open as long as there is drainage. Another type of incision is a short one just underneath the angle of the jaw through which a curved hemostat is directed upward and inward, following the inner surface of the mandible. Still another method of drainage consists in removal of the tonsil and puncture of the superior constrictor pharyngeal muscle and aponeurosis with a blunt instrument, allowing drainage through the throat. In recent years the sulfonamide compounds have been widely used, and the reports on their use as a whole have been favorable. Transfusion of blood and intravenous injection of dextrose and saline solution are used with excellent results to counter the toxicity and the dehydration.

"Ludwig's angina" is the generally accepted term for infection involving the submandibular space, Wilhelm Friedrich von Ludwig, of Stuttgart, Germany, having described the condition in 1836. A good definition seems to be that given by Grodinsky [1g,h] when he stated that the term should be reserved for infection starting in the floor of the mouth, usually from carious lower molar or bicuspid teeth, spreading to the submental and submaxillary triangles by fascial planes and causing serious symptoms of edema of the tongue and the glottis, mediastinitis or toxemia. This definition practically eliminates the throat, the tonsils and the pharynx as the seat of the initial lesion.

The space involved is under the floor of the mouth and is so limited by dense fascia and muscle attachments that much pressure is withstood before the involved tissues rupture into other spaces or into the mouth. The floor consists of (1) the dense layer of cervical fascia attached anteriorly and laterally to the lower border of the mandible, posteriorly to the hyoid bone, and (2) the mylohyoid muscles. The limiting wall is composed of the following structures: posteriorly and above, the muscles uniting to form the base of the tongue; laterally, the bodies of the mandible; superiorly, the tongue and the mucosa of the floor of the mouth; anteriorly, the anterior bar of the mandible. The mylohyoid muscle is of importance surgically in that when infections lying above it invade the neck they invade deep to the thyrohyoid membrane and enter the laryngeal submucosa, thus producing laryngeal edema, while infections lying below it, when they invade the neck, are superficial to the thyrohyoid membrane and do not enter the laryngeal tissues. Tschiassny [1p] has called attention to another anatomic point of interest, that the mylohyoid ridge of the mandible

3. Grodinsky, [1g, h]

to which the mylohyoid muscle is attached, is so placed that the roots of the second and third molar teeth are deep to it, while roots of the other teeth are superficial—thus accounting for the fact that infections from these two teeth cause the great majority of infections of this type in the submandibular space. Another point, noted by Trout,[10] is that the sockets of the lower molar teeth are placed nearer the lingual than the buccal surface, causing the plate to be thinner on the lingual side and making it easier for infection to burrow through to the floor of the mouth.

The mortality rate has varied in different series of reported cases from zero to 60 per cent, the later series with early radical surgical intervention in conjunction with the use of sulfonamide compounds showing more favorable results.

As stated, the etiology concerns preponderantly infections arising from around the lower molar teeth. The disease may be due to caries, or it may arise from trauma involving these teeth. Other causes are trauma to the floor of the mouth and extension of infection from other spaces, such as the parotid or the parapharyngeal. The infecting organisms are no different from those found in pharyngomaxillary abscesses except possibly that Vincent's organism is more frequently found,[1c] nor is there any marked difference in the age incidence.

The usual symptoms are those of a rapidly fulminating infection beginning with a small painful swelling underneath the mandible in the right or the left suprahyoid space, which within a few hours may progress to a marked degree, distending the tissues outward in an indurated, woody, massive swelling extending all the way across the neck to the opposite side. The tongue is swollen, thickened and elevated, being forced back into the upper pharynx; the mouth is opened with difficulty if at all; the tissues in the floor of the mouth are edematous, reddened and swollen; the hyoid bone and its attachments are pulled forward and upward, taking the larynx along. This event, together with the swollen tongue forced backward into the pharynx, is often productive of mechanical blocking of the airway and serious respiratory embarrassment. There is marked general discomfort, with dysphagia and dysphonia, fever, toxicity, dehydration and prostration. Unless checked, there is a great and imminent threat to life. Dorrance[1d] has described the clinicopathologic picture as follows: "... the tissues cut as if they were frozen, the wound gapes and the cut surfaces have the appearance of liver tissue; gas may escape; the discharge is serous but never pus-like in character; as a rule there is a foul odor present."

Complications include asphyxiation due to mechanical blocking of the airway, extension of infection into other cervical fascial compartments, mediastinitis, osteomyelitis of the mandible and hyoid bones, generalized septicemia, pneumonia and pulmonary abscess.

The treatment accepted generally before the advent of chemotherapy was early and radical incision of the involved tissues. The primary purpose of this procedure is not to release purulent and infected material but rather to achieve a decompressive effect by wide incision of the fascia and the muscles.[11] This is accomplished by an incision beginning just below and anterior to the angle of the jaw and running forward parallel to and 1 cm. below and medial to the inner margin of the mandible until it reaches the midline anteriorly; if bilateral, the incision is continued until it reaches the initial starting point on the opposite side, thus taking the shape of a horseshoe. The deep fascia is incised widely, likewise the fibers of the mylohyoid and geniohyoid muscles. Blunt dissection is then carried up to the floor of the mouth with the finger or the forceps, care being taken not to open the mucosa. Some authors have recommended the ligation of the facial artery and vein. This decompressive procedure releases the tension which is pulling the tongue up and back, and the hyoid bone and the larynx up and forward, thus relieving the mechanical obstruction to breathing. It is followed almost immediately, before the patient leaves the operating room, by relief from respiratory embarrassment, the breathing becoming free and the look of tenseness and anxiety disappearing. The wound is left open, and warm, moist antiseptic compresses are applied locally. Packing may be necessary to keep the wound open. Local anesthesia induced by infiltrating the tissues with 1 per cent procaine hydrochloride is advised. In children general anesthesia may be used, induced by administration of nitrous oxide and ether or by intravenous injection of a barbiturate. Bennett[1a] advocated endotracheal administration of nitrous oxide and ether, though it would appear a rather formidable procedure to insert an endotracheal tube in the presence of an infection of the neck. His practice is to leave the tube until the first dressing is done, which would offer a more certain airway than could be had without it. In any instance a tracheotomy set should be readily available at all times, as respiratory embarrassment may come on suddenly and unexpectedly. A nasal feeding tube for the intake of liquids is worth while and adds to the comfort and nutritive support of the patient. Sulfonamide compounds are highly recommended,

and if swallowing is too difficult, they may be given intravenously.[4] Blood transfusion and injection of dextrose and saline solution are indicated here as in the treatment for pharyngomaxillary abscesses. Neoarsphenamine has been recommended on the basis that Vincent's organism is often an etiologic factor.[1c]

Experience with penicillin in a fairly large number of cases over a period of more than a year had led to the conclusions that (*a*) the agent is effective as a rule against the organisms most usually associated with deep infections of the neck, namely, the staphylococcus, the streptococcus, the pneumococcus and Vincent's organism; (*b*) the more sensitive the organism to penicillin and the more acute the infection, the better is the result from such therapy; (*c*) infections of soft tissues frequently resolve without recourse to surgical drainage when the patients are treated with penicillin; (*d*) the effect of the drug is often noted within a few hours. When these facts were taken into consideration, it was felt that a trial treatment, withholding surgical intervention, would be rational and safe. Further consideration was given to the experience that in 13 per cent of patients infected with Staphylococcus aureus and in 19 per cent of patients infected with Staphylococcus albus, these organisms, originally sensitive to penicillin, have under treatment developed, rather early, a certain degree of resistance to the agent. Added to this was the knowledge that these infections are of immediate seriousness and demand the earliest possible relief. Based on such considerations, the decision was made to give initially 20,000 to 40,000 units of penicillin intravenously, followed by 5,000 units every half hour for from eight to thirty-six hours. The agent was given by dissolving 1,000,000 units in a liter flask containing saline or dextrose solution, and the rate of flow was so regulated that 5,000 to 10,000 units was delivered every half hour. An alternate method was to begin an intravenous injection of saline solution containing dextrose in 3 to 5 per cent concentration and, with a hypodermic needle, to inject the penicillin into the rubber tubing just above the intravenous needle. Simultaneously 25,000 units was given intramuscularly and the injection repeated every three hours for from five to twelve days, dependent on the clinical improvement.

REPORT OF CASES

CASE 1.—A white man aged 20 was admitted to a General Hospital May 17, 1944 with a history of having undergone tonsillectomy under local anesthesia seventeen days earlier at a nearby Station Hospital. The clinical record from that hospital revealed that the tonsils were removed by dissection and use of a snare and that 30 cc. of 1 per cent procaine hydrochloride had been used by infiltration for anesthesia. The notes on progress indicated that there was a temperature of 99 to 100.6 F. daily from May 1 through May 5 and that the temperature was 99.4 to 102.8 F. from May 9 to 17. Administration of sulfathiazole was begun on May 11. At the angle of the left jaw there was a swelling which was tender but not fluctuant. The patient complained of pain and soreness in the neck with inability to open the mouth wide.

On admission to this hospital he presented the typical picture of pharyngomaxillary abscess: the evident distress; the ashen pallor; the anxious look; the fixed lower jaw; the inability to open the teeth even the width of a tongue depressor; the tender woody swelling in the region of the angle of the left jaw, extending downward to the hyoid bone, backward below the lobe of the ear, forward almost to the symphysis mentis and upward to the zygoma. The temperature was 101 F.; the pulse rate, 100. The tonsils had been removed cleanly, but the left tonsillar bed was reddened and displaced inward. The white blood cell count was 17,850, with 86 per cent polymorphonuclear leukocytes. The diagnosis was pharyngomaxillary abscess on the left side.

On the following day the patient was taken to the operating room. Local anesthesia was induced with 1 per cent procaine hydrochloride, and a 1½ inch (3.5 cm.) incision was made into the swollen tissues just below and underneath the angle of the left jaw. A curved Kelly hemostat was introduced and carried upward and forward hugging the body of the mandible for a distance of approximately 1½ inches, at which point a few drops of foul greenish pus were obtained. Following the surgical procedure, the temperature was 104 F., and there was a chill. Because of the seriousness of the infection, penicillin therapy was started immediately, 20,000 units being given intravenously, followed by 5,000 units every half hour, given in isotonic solution of sodium chloride containing dextrose in the concentration of 5 per cent. This was continued for seven hours. At the same time intramuscular injection of penicillin was begun, 25,000 units being given every three hours, and was continued for five days; a total of 2,120,000 units was given. A culture had revealed the presence of Staph. aureus. Within twelve hours after the surgical treatment and the initiation of the penicillin therapy the patient was much more comfortable, the fever, the discomfort and the swelling having been materially lessened. At the end of five days there was no drainage and only slight induration underneath the angle of the jaw. In addition to the injection of penicillin, supportive treatment was given in the form of dextrose in saline solution, intravenously. Hot, moist magnesium sulfate compresses were applied locally. Recovery was uneventful and rapid.

CASE 2.—A white man aged 27 was admitted to a General Hospital Sept. 19, 1944 from a nearby Station Hospital with the following notes: "The patient was transferred to the eye, ear, nose and throat service September 18 for treatment of a peritonsillar abscess. There is massive swelling over the left cheek and the angle and the ramus of the left mandible and below the left jaw. This swelling is diffuse and not limited by the belly of the digastric muscle. It is firm and hard, without evidence of fluctuation. The teeth and the gums appear to be in good condition. There is a moderate amount of swelling in the region of the left tonsil

4. Fulghum.[1f] Hendricks.[1j]

There is some tenderness over the great vessels at the root of the neck."

At this hospital on admission the findings were essentially the same as those described at the Station Hospital with the following additions:

The patient was a pale, anxious, acutely ill white man with a tender indurated swelling around the angle of the left jaw. The mouth opened with difficulty, and there was painful swallowing with muffled voice. The left tonsillar region was swollen to the extent that it occupied almost two thirds of the pharyngeal fossa. The temperature was 101 F.; the pulse rate, 100; the white blood cell count was 14,000, with 74 per cent polymorphonuclear leukocytes. No material was obtainable for culture. The diagnosis was pharyngomaxillary abscess on the left side.

On September 19 penicillin therapy was begun, 25,000 units being given intramuscularly every three hours, and continued until September 30 a total of 2,100,000 units being given intramuscularly. In addition to the penicillin injected intramuscularly, 250,000 units was injected intravenously. Supportive treatment was given in the form of 5 per cent dextrose in isotonic solution of sodium chloride. Local treatment included hot, moist compresses to the neck.

Within twelve hours after the beginning of the penicillin therapy there was marked amelioration of the symptoms and the patient appeared much more comfortable. The swelling gradually disappeared, as well as the pain and the trismus. All treatment was discontinued on September 30. The patient remained in the hospital until October 5, at which time he was returned to duty.

CASE 3.—A white man aged 22 was admitted to a General Hospital on March 31, 1944 with a history of sore throat on the left side and a lump in the neck, first noted on March 30. During the night of March 30 he was unable to sleep because of pain under the left side of the jaw, and he noticed increased swelling. He reported to the dispensary on the following morning and was started on sulfadiazine therapy and referred to this hospital. On admission he appeared acutely and seriously ill. There was marked swelling of the jaw and the neck on the left side; the tongue was edematous and thickened and appeared to be pushed upward and backward, the swelling involving the soft tissues in the floor of the mouth. There was slight evidence of cyanosis but little other evidence of respiratory embarrassment. No focal lesion could be located. The temperature was 101.8 F.; the pulse rate, 90; the respiratory rate, 20. The white blood cell count was 20,000, with polymorphonuclear leukocytes 88 per cent. Smear and culture of material from the nasopharynx showed the predominating organism to be Staph. aureus with the nonhemolytic streptococcus. The diagnosis was Ludwig's angina on the left side.

Intravenous administration of penicillin was immediately begun; 25,000 units was given initially, followed by 7,500 units every half hour for eighteen hours. The drug was also injected intramuscularly, 25,000 units every three hours. Supportive treatment consisted of intravenous injection of 5 per cent dextrose in isotonic solution of sodium chloride, together with nasal administration of oxygen. Hot, moist compresses were used locally. The intramuscular injections of penicillin were continued for eight days, the patient at this time having made an uneventful recovery. The total number of units administered was 1,895,000. There was marked relief within eight hours after the inception of treatment. No focus of infection having been found, the patient was referred to the dental clinic after recovery, where it was found that there was an abscess of the lower left third molar tooth. On the following day this tooth was extracted and a pocket of pus found at this root. Recovery ensued, with return to full duty.

CASE 4.—A white man aged 24 was already a patient in a General Hospital. An upper removable partial denture was fitted on Nov. 11, 1943. Three days later, November 14, a swelling was noted below the angle of the right mandible and around the right lower second and third molar teeth. There was slight fever, accompanied with dysphagia, trismus and a general feeling of illness. He was immediately treated with sulfadiazine by mouth, hot moist compresses to the neck and rest in bed. On the following morning, the swelling had increased, and the patient appeared much more ill. The swelling was approaching the midline in the submandibular region and was spreading downward toward the clavicle. The tongue appeared thickened and pushed upward. Breathing became difficult, and the voice was muffled. The temperature was 102 F., the white blood cell count was 15,960 and there were all the evidences of a serious infection. The diagnosis was Ludwig's angina on the right side.

Penicillin therapy was begun, 20,000 units being injected intravenously as an initial dose, then 5,000 units every half hour. Intramuscularly, 25,000 units was given and the injection repeated every three hours for nine days. A total of 1,810,000 units was given. Within eight hours there was definite improvement; the patient appeared more comfortable, and the swelling had begun to subside; swallowing was easier and he was beginning to take fluids by mouth. Five per cent dextrose in isotonic solution of sodium chloride was given intravenously as indicated, and the usual hot fomentations were applied locally. Culture of material from a draining area in the mouth showed Staph. albus and the nonhemolytic streptococcus. On November 4 the lower right second molar tooth was removed and a large periapical abscess found. There were no complications following this.

There was continued improvement, and the administration of penicillin was discontinued on November 24. The patient was referred back to the orthopedic service as cured.

SUMMARY

Four patients with deep infection of the neck—2 with Ludwig's angina and 2 with pharyngomaxillary abscess—were treated with penicillin. Only 1 patient was operated on, and that was before the administration of penicillin began. All were seriously ill, their conditions well defined clinically, and all recovered. It is believed that penicillin will prove a most valuable agent in the treatment of patients with such infections.

LOCAL USE OF SULFATHIAZOLE IN MASTOIDECTOMY WOUNDS

SATISFACTORY RESULTS OBSERVED IN THIRTY PATIENTS

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While chief resident physician in otolaryngology at the Graduate Hospital of the University of Pennsylvania, I became interested in the local effects of sulfathiazole on chronic mastoiditis.

The effectiveness of sulfonamide drugs in the treatment of diseases which formerly had a high mortality rate challenges every physician today to discover more loci where chemotherapy may be applied. According to Kolmer,[1] ". . . the local or oral administration of sulfanilamide and its derivatives for the prevention of infection is worthy of serious attention and wider application. This is true not only in relation to superficial wounds and burns but with regard to the prevention of puerperal sepsis, gas gangrene, epidemics of sore throat, the extension of hemolytic streptococcic infection to the middle ear and mastoid cells, peritonitis after injury or the rupture of appendical abscesses, infection after accidental pricking of the fingers in the operating or necropsy rooms. . . ."

It is the purpose of this paper to present the results obtained in using sulfathiazole in mastoidectomies, in respect to its local effects at the time of the operation and when use is continued postoperatively. Mastoidectomies, presenting necrotic tissue and bone with a poor blood supply, are especially choice cases for study in respect to the effectiveness of the sulfonamide compounds, since extensive research on them, done in the past few years by men interested in their therapeutic value, has shown that their effectiveness when administered orally or intravenously depends on the proper blood concentration.[2]

TREATMENT AND CLINICAL OBSERVATIONS

The patients used for study and observation for this paper were selected at random from those who presented themselves at the otologic clinic of the Graduate Hospital. They presented problems of suppurative mastoiditis, with and without complications, and with a past history of otorrhea lasting over a period of six months to fifteen years. Some of the patients had already had simple mastoidectomies, but otorrhea had continued. The roentgen examinations showed variations from thickening of mucous membranes with destruction of bone to complete sclerosis.

The otoscopic examinations showed variations from marginal perforations with a mucopurulent discharge (of foul odor) to a complete destruction of the tympanic membrane with the presence of granulated tissue and cholesteatoma.

Some patients gave a history of having formerly received a series of treatments with sulfanilamide or sulfathiazole over a two week period.

In cases in which need for a mastoidectomy seemed less immediate, conservative treatment was employed. This consisted of removing granulation tissue with a solution of silver nitrate (10 to 30 per cent) and irrigating the middle ear with a 5 per cent solution of sodium sulfathiazole, as well as insufflating sulfathiazole powder.

For those patients who had a profuse discharge, I prescribed a 5 per cent solution of sulfathiazole sodium sesquihydrate and instructed them to use 10 drops in the affected ear three times daily. I saw them two or three times a week. In addition to local therapy the patients were given sulfonamide drugs by mouth four times daily for one to two weeks. During this time, they had the usual blood examinations for evidence of toxic symptoms. In addition, the patients were asked to include liver and multivitamins in their diets. Although the constitutional therapy with sulfathiazole was given for no longer than two weeks, the local applications were continued for a period of two to six weeks at the clinic.

With this conservative treatment results were discouraging, since the otorrhea was intermittent or continued in every case. Of the patients with chronic suppurative mastoiditis whom I saw, not one responded to sulfathiazole by mouth and by

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This paper is a thesis submitted to the Faculty of the University of Pennsylvania Graduate School of Medicine in partial fulfilment of the requirements for the degree of Master of Medical Science (M.Sc. [Med.]) for graduate work in otolaryngology.

1. Kolmer, J. A.: The Science of Chemotherapy, Arch. Otolaryng. **34**:1 (July) 1941.

2. Maxwell, J. H.: The Sulfonamide Drugs in the Treatment of Acute Suppurations in the Middle Ear and Mastoid, Surg., Gynec. & Obst. **74**:573, 1942.

local application. The ears kept on draining not only after a few months of treatment but even much longer. As stated formerly, there are a few cases of the series that included a history of otorrhea and treatment up to fifteen years following a simple mastoidectomy.

Persistent and prolonged otorrhea complicated by temporal headache, especially following continued use of chemotherapy, was one of the main indications for mastoidectomies. Dr. George M. Coates had often pointed out that this type of headache has been an important symptom since the advent of chemotherapy. There are many instances in recent literature in which chemotherapy has masked the symptoms of intracranial complications from an infection in the mastoid.

In this series there were a few patients who, after having had one mastoid operation, still were troubled with otorrhea; they came to the clinic because of acute exacerbation of the chronic mastoiditis. These patients had the usual characteristic indications for mastoidectomy such as fever, pain, headache, tenderness, sagging of the supraposterior canal wall, deafness, the granular, purulent type of otorrhea, leukocytosis, with and without cavitation, or the sclerotic type of mastoid roentgenographically observed. Treatment having failed and subjective complaints continuing, such as vertigo, temporal or occipital headache or a foul discharge (suggesting cholesteatoma), hospitalization and an operation were advised. Each patient was then given a thorough physical examination, including hearing tests, roentgen studies and the routine laboratory studies—urinalysis, complete blood count and serologic tests of the blood. Other blood tests were carried out when indicated.

OPERATIVE AND POSTOPERATIVE METHODS

The infective process was carefully eradicated by radical removal of all possible carious and necrotic bone and by exenteration of possible mastoid cells, whether situated in the zygomatic area, dural plate, lateral sinus plate or over the perilabyrinthine region and in the mastoid tip. The middle fossa dura and lateral sinus dura were routinely exposed in all patients with chronically infected mastoids. In some there was a pathologic exposure, but in the majority of cases an intentional exposure was made in order to visualize the state of the dura. Regardless of the nature of the exposure, the opening was made large enough to allow proper drainage should infection set in. Although such a routine procedure is not accepted by many otologists, this method was used (with full approval), and no complications resulted.

In all radical mastoidectomies the Panse flap was used. The meatal opening at the time of operation was large enough to allow the entrance of the little finger; such an opening would assure a postoperative meatus. A gauze drain was placed within the mastoid cavity, and both gauze and cavity were filled with sulfathiazole powder. The mastoid cavity was actually filled, not merely dusted, with the powder. The average quantity of powder used was 2 drachms (7.76 Gm.). In all radical operations, the opening was closed up tightly posteriorly, the periosteum and the skin being sutured together. The external incision was covered with sulfathiazole ointment gauze and a dry dressing; this remained unchanged until the fourth day, when most of the sutures and a portion of the drain were removed. Then 5 per cent sulfathiazole ointment and a dry dressing were applied. On the sixth day, if the incision appeared to have healed, the remains of the suture and of the drain were removed. From the sixth day on, discharge in the external auditory canal was first removed with a dry cotton applicator. The external auditory canal was then irrigated, as well as the mastoid cavity, with a warm solution of 5 per cent sulfathiazole. In a few instances the patient was given 5 per cent sulfathiazole for home use, with instructions as to its use: 10 to 15 drops in the ear, every three hours, or about four times daily.

Some patients were asked to return in three days for reexamination and treatment, which consisted of irrigation or mopping and insufflation of sulfathiazole powder. None of the patients in this group required more than three weeks of postoperative care; for some, one week was sufficient. In no one case was it necessary to cauterize; there was little or no granulation tissue seen. The incisions healed by primary union, and they were of sufficient strength that on the removal of the sutures on the fourth day the appositions held fast. In addition, no postauricular depressions or fistulas resulted.

(In passing, I want to mention that I had had occasion to observe the action of sulfathiazole on deep tissues while studying under Dr. Gabriel Tucker. Healing and postoperative results when sulfathiazole powder was used at the time of closure and postoperatively, following laryngectomy, laryngofissure and tracheotomy, were decidedly good. After operations which I performed or in which I assisted and gave postoperative care, no deep or superficial infection occurred. In addition, the surgical reaction was minimized as compared to that in operations done without the implantation of sulfathiazole.)

In some cases, the postoperative care was not identical with that in others. Variations were made in respect to the day of removing the sutures or the gauze drain or to the frequency of postoperative care, but all patients had the advantage of the use of sulfathiazole in powder and in 5 per cent solution.

POSTOPERATIVE RESULTS

With the exception of 1 case, postoperatively results in all cases were favorable; the ears became epithelized and dry. Some patients, as shown in the reports of cases, required postoperative care for from one to three weeks; others did not require any special care, as there was no recurrence of otorrhea from the time these patients were discharged. The patients were asked to come in periodically through the year, and their ears were examined in the course of the clinical study.

Only 1 patient in this group did not respond to treatment, since the treatment was never

completed. The patient was uncooperative, did not return to the clinic soon after discharge as requested and was careless in the regularity and method of home medication, disregarding all advice on auditory hygiene and on the danger of swimming with the existing otorrhea. The patient returned some four months after the mastoidectomy with a draining ear and nasopharyngitis and some five months after that visit again came in for treatment of nasopharyngitis and otorrhea.

It is interesting, at this time, to study the results obtained by other surgeons. The percentage of dry ears following radical mastoidectomies in which sulfonamide drugs had not been used was reported by Hastings.[3] The results of his own operations showed 46 per cent of his patients with dry ears after radical mastoidectomies. He also cited results of Fraser as 25 per cent, Jessen 42 per cent and White 57 per cent.

As a control in the series described in this paper, patients were treated with sulfathiazole powder for the otorrhea before operations were performed. There was no amelioration of the otorrhea after the preoperative treatment. It was only after complete exenteration of all infected mastoid cells, in addition to the use of sulfathiazole powder locally, that the otorrhea was arrested. Considering Hastings' report and the good results in my cases, I judge that the difference in my results was due to the use of sulfathiazole locally at the time of the operation and postoperatively.

The question might be asked as to whether it was the sulfathiazole which caused the high percentage of success in arresting the otorrhea. Might it not have been possible that through extensive surgical eradication of infected cells the focus and source of intracranial complications were removed? Every one knows that skilled surgeons have done so many times in the past. But, without the use of sulfathiazole, they have not had the successful recoveries which I, and others using sulfathiazole, have had uniformly in similar operations.

In this series the absence of complications in operations with local chemotherapy is significant. The use of sulfathiazole locally should be credited with abortive as well as preventive powers. My results and those of other surgeons who have used sulfonamide compounds in mastoid surgery as compared with the results of surgeons operating before their use demonstrate that properly used they are the wonder drug of this day, if only for having lessened the mortality rate for mastoiditis and cerebral complications.

Johnson [4] found that complications after operations developed in 36 per cent of the cases in mastoid surgery prior to use of sulfathiazole.

Towson [5] listed the mortality rate for operations for chronic mastoiditis as reported by several men, as shown in the following table.

Towson's [5] Report of the Mortality Rate for Operations for Chronic Mastoiditis in Which No Sulfathiazole Was Used

Surgeons	No. of Cases	Mortality Rate, %
Kafka (Laryngoscope **45**: 790, 1935).....	1,125	5.80
	186	6.90
	122	16.60
Dixon (cited by Kafka).....	60	10.00
	77	6.40
Kreutz and Witter (Ann. Otol., Rhin. & Laryng. **46**: 1060, 1937).....	300*	6.30

* These 300 are cases of acute mastoiditis.

Persky [6] reported results of complications of otitic infections for 33 cases in which no sulfathiazole was used. There were 28 recoveries and 5 deaths from meningitis, a mortality rate of 15 per cent.

ACTION OF SULFATHIAZOLE

It would be expedient here to discuss the action of sulfathiazole where necrotic bone is involved, its general action and its pharmacologic and toxicologic nature.

Generally, the principal abuses of sulfonamide therapy in surgery arise from a misconception of the local action of these drugs. Sulfonamide compounds are bacteriostatic and not bactericidal. A necrotic mastoid with active suppuration of the temporal bone may produce dangerous intracranial extension of infection. It is, therefore, important to remove the inciting focus. Williams and associates [7] stated that on the basis of a review of literature considering the mode of action of the drug, it would seem that the sulfonamide drugs act best in an environment in which good blood and oxygen supply are

3. Hastings, S., in discussion on the Operative Treatment of Chronic Mastoid Disease, Proc. Roy. Soc. Med. **31**:331, 1937.

4. Johnson, H. P.: Temperature After Mastoidectomy: Study of One Hundred Cases, Arch. Otolaryng. **19**:660 (June) 1934.

5. Towson, C. E.: Acute and Chronic Mastoiditis, Arch. Otolaryng. **38**:32 (July) 1943.

6. Persky, A. H.: Pneumococcus Type III in Otitic Infections, Arch. Otolaryng. **34**:473 (Sept.) 1941.

7. Williams, H. L.; Brown, A. E.; Herrell, W. E. and Ralph, R. D.: Sulfonamide Therapy for Acute Otitis Media and Mastoiditis, Ann. Otol., Rhin. & Laryng. **50**:336, 1941.

present, one which is free of peptones and broken-down leukocytes and which is not constituted of bone. The middle ear and mastoid process are essentially bone loci with a poor blood supply. I shall now consider how sulfathiazole is effective in mastoidectomies.

As pointed out by Kolmer,[1] "There can be no doubt about the effectiveness of local applications of sulfanilamide crystals in the prevention and treatment of infections of superficial wounds and burns and of local peritonitis. Indeed, it would appear that the local or oral administration of sulfanilamide and its derivatives for the prevention of infection is worthy of serious attention and wider application. This is true not only in relation to superficial wounds and burns but with regard to the prevention of puerperal sepsis, gas gangrene, epidemics of sore throat, the extension of hemolytic streptococcic infection to the middle ear and mastoid cells. . . ." Since the powdered preparations have been used with much success for soft tissue wounds due to trauma, for osteomyelitis and postoperatively for surgical wounds, it might follow that their use for suppurative and surgical conditions of the ear would be of value. However, in this series of cases of chronic mastoiditis sulfonamide drugs were not effective at all in the presence of necrotic bone. No matter how long the patient was treated prior to exenteration of necrotic cells, the suppurative condition was not controlled, and the possibilities for intracranial complications of an extradural abscess or acute suppurative meningitis by way of the lateral sinus or through the labyrinth or by extension along the small vessels were always feared. By the same mode of extension, brain abscess or sinus thrombosis or petrositis could be anticipated.

The mode of action, according to Meleney and Lockwood,[8] of sulfathiazole (2-sulfanilamidothiazole), a derivative of the sulfonamide group, was found to be bacteriostatic rather than bactericidal, specific in its action and highly effective in serum. A sulfonamide compound, when used on a small concentration of streptococci in a test tube, inhibited their growth. In the very same manner, a sulfonamide drug, when given by mouth at a concentration of 10 mg. per hundred cubic centimeters, inhibited the hemolytic streptococci when the latter were in the same concentration within the blood. In both instances it was bacteriostatic in effect. However, this same concentration of a sulfonamide drug could not stop the growth of large numbers of organisms. Furthermore, bacteriostatic or bactericidal effects of sulfonamide drugs could be frustrated by the presence of peptones in the medium.

Lockwood and Lynch[9] have shown that sulfanilamide has a bacteriostatic effect on certain species and on small numbers of bacteria within the blood and that small numbers do not render the drug inactive but that large numbers do. They also point out that normal tissues absorb the drug without altering it but damaged tissues or pus inhibit the drug. This inhibition, they explain, is due to the presence of peptones, since in the test tube these split products of protein have been shown definitely to inhibit the bacteriostasis of sulfonamide drugs.

Woods[10] has shown that paraaminobenzoic acid is a specific inhibitor of sulfanilamide; that the acid is utilized by bacteria in their growth processes; further, that the acid is, possibly, a constituent of all animal protein. Paraaminobenzoic acid is a substance known to be one of the requirements for bacterial growth. Its structural similarity to sulfanilamide has suggested that the latter may be taken up by the bacterial cell in the place of paraaminobenzoic acid. The bacterial cell, then, not being able to utilize the drug, fails to multiply and either dies of malnutrition or falls an easy prey to the phagocytic activity of the leukocytes. Thus, the sulfonamide drugs may not directly kill bacteria but rather only interfere with their nutrition.

The course of action of sulfanilamide on various bacteria and the behavior of the drug in the body have been explained by Meleney and Lockwood[9] by the theory that bacteria must utilize the nutrient elements in the immediate environment and in so doing gain a foothold in the body tissues or, in like action, multiply within the culture medium. This utilization is accomplished with the help of enzymes. These enzymes, by the process of digestion, break elements into simpler substances which can be absorbed and utilized by bacterial cells. If the metabolism of the bacterial cells were the same as that of the tissue cells, the bacterial cells could go on living with the body cells in a perfect symbiosis. But bacterial cells, in most instances, multiply rapidly and may, in so doing, excrete toxins which, while entirely incidental to growth processes, may destroy the tissue cells and phago-

8. Meleney, F. L., and Lockwood, J. S.: The Chemotherapy of Surgical Infections, S. Clin. North America **22**:479, 1942.

9. Lockwood, J. S., and Lynch, H. M.: Studies on the Mechanism of Action of Sulfanilamide: Influence of Proteolytic Products on the Effectiveness of Sulfanilamide, J. A. M. A. **114**:935 (March 16) 1940.

10. Woods, D. D.: Relation of Paraaminobenzoic Acid to the Mechanism of Action of Sulfanilamide, Brit. J. Exper. Path. **21**:74, 1940.

cytes in the immediate environment. Anything which can prevent the utilization of the surrounding nutrient elements by the bacteria will prevent their multiplication.

The pharmacology of sulfanilamide must be considered. According to Marshall,[11] after the absorption of sulfanilamide into the blood stream the drug is split by the liver into a free, or active, factor and into an acetyl, or inactive, factor; the latter is more toxic. The diffusion of the sulfonamide drugs into body tissues and fluids varies in relation to vascular supply, so that in areas of chronic infection diffusion in bone and necrotic tissue may be deficient. With the exception of sulfathiazole, they pass readily into a cerebrospinal fluid and also into the red blood cells. They are excreted for the most part in urine, in either a free or an acetylated compound and, with the exception of sulfadiazine, within twenty-four hours.

The toxic manifestations due to sulfathiazole, according to Flippin,[12] are greater in degree than those due to sulfanilamide. Because of personal idiosyncrasies of different patients, the toxic effects of sulfathiazole are unpredictable. Drug fever, dermatitis, nausea and vomiting appear more frequently when sulfathiazole is used than when sulfanilamide is used. Cyanosis is less pronounced in persons receiving sulfathiazole than in those receiving sulfanilamide. Instances of hematuria, whether or not accompanied with renal failure, have been noted in patients receiving sulfathiazole. The appearance of hematuria is explained by the fact that the acetylated forms of sulfathiazole are less soluble in the urine than are the free drugs and often crystallize in the tubules of the kidney and thus block the outflow of urine. Because acetylsulfathiazole crystals are frequently found in the urine of patients who are receiving sulfathiazole, it is wise to alkalinize and also to increase the daily intake of fluid by 2,500 cc., so that the urinary output may be kept at a normal level (from 1,200 to 1,800 cc. or slightly above). This precaution at the same time lessens the possibility of calculus formation.

REPORT OF CASES

The 11 cases to follow have been selected from the 30 in which I operated and assisted and are representative of them. These largely concern patients with chronic otorrhea which had not responded to conservative treatment and w were therefore hospitalized for mastoidectomi Exceptions are noted.

CASE 1.—A male patient, 54 years old, was admitt to the otolaryngologic ward of the Graduate Hospit on Sept. 8, 1942. The diagnosis was acute perforati zygomatic mastoiditis. The patient had complained painful swelling behind the left ear and anterior to t external auditory canal of the left ear. He gave history of pain and discharge in the left ear for s months prior to his admission.

He did not appear acutely ill when seen in the wa He gave his weight as 190 pounds (86.2 Kg.) a height as 5 feet 6 inches (167.64 cm.).

The left side of his head adjacent to the ear w swollen and edematous and tender when touched. T external canal was filled with a serosanguineous di charge. Otoscopic examination revealed a congest and bulging tympanic membrane with a posterior pe foration and sagging of the posterior-superior can wall. The patient gave a history of diabetes on controlled but not under control at this time. The was also a history of a nephrectomy. A tumor ma had been removed from the scrotum with a postoper tive draining sinus resulting. The patient had had umbilical hernia for the previous ten years and a rig direct inguinal hernia. Because of the uncontroll diabetes, a postauricular incision was made with t patient under vinethene anesthesia and the wound w packed. While this was draining, the patient's di betes was controlled in preparation for the operati

On the day of the postauricular incision the labora tory report of urine and blood examinations was a follows: The urine contained a trace of albumin an 5.1 per cent of sugar; the blood contained 346 m of sugar per hundred cubic centimeters. The follo ing day the blood contained 266 mg.

The simple mastoidectomy was completed Septemb 12 with the use of local anesthesia and vinethen The laboratory report of that date showed: blo sugar 174 mg. per hundred cubic centimeters, ur nitrogen 19 mg., chlorides 540 mg. and plasma bica bonate carbon dioxide capacity 60 per cent.

The smear from the pus in the mastoid cavi showed hemolytic streptococcus. Roentgenologic exam ination of the left mastoid revealed a large area rarefication lying posterior to and slightly above t region of the canal which might indicate a cholestea toma. A similar area was seen in the mastoid t on the left side. The walls of the external canal we less clearly defined than those on the right side owi to haziness in this region, and this would seem to ind cate a mastoid in which previous disease had occurre and in which active infection associated with destru tion of bone was then present.

During the operation a fistula about 5 mm. in diam eter was found in the cortex of the zygoma. T entire mastoid was necrotic, and there was no evidenc of cholesteatoma. The patient was given the car described in this paper, sulfathiazole being employe Postoperative recovery was uneventful. The patie left the hospital on the twelfth postoperative day. T blood sugar at that time was 148 mg. and the ea was dry.

The referring physician, who followed the patient progress, reported no recurrence of discharge in t affected ear. When one considers the previous su gical and medical history of the patient, it appear that he made an excellent recovery.

11. Marshall, E. K., Jr.: Bacterial Chemotherapy: Pharmacology of Sulfanilamide, Physiol. Rev. **19**:240, 1939.

12. Footnote deleted.

CASE 2.—A female patient, 17 years old, was admitted to the Graduate Hospital on October 7, 1942, with a diagnosis of chronic mastoiditis. She had had a running ear since the age of 6 and had had a simple mastoidectomy at 7, but the discharge had persisted. She had been given conservative treatment at another hospital prior to coming to the Graduate Hospital. She had little hearing on the involved side, the audiogram showing a 70 decibel loss in the range from 128 to 2,048 cycles.

The patient's ear had a thick and foul discharge. Otoscopic examination revealed the presence of only a very small portion of the anterior half of the drum and granulations in the middle ear.

Physically, the patient was well developed, appeared well nourished, had normal station and gait and did not seem nervous.

Laboratory studies disclosed a negative Kahn reaction, and results of examinations of the urine and blood were negative. Roentgenologic examination as reported by the referring physician gave evidence of a previous mastoidectomy with indications of cholesteatoma.

A radical mastoidectomy was performed on October 10, and a cholesteatoma was found in the antrum and epidural angle. The postoperative care with sulfathiazole, as described in this paper, was followed. The patient left the hospital in eight days, since the postoperative course was uneventful.

Her hearing after the operation was better. The culture of the exudate, made after the pack was removed, was negative for growth. The ear dried within two weeks after operation and remained dry.

CASE 3.—A 2 year old male child was admitted to the otolaryngologic ward of the Graduate Hospital on July 6, 1942. The child had had a discharge from the right ear for the past fifteen months with an exacerbation following measles. His right ear was discharging and filled with a mucopurulent, blood-tinged exudate, which was foul in odor.

Preoperative examinations of urine and blood disclosed nothing of significance. Roentgen examination of the mastoid showed partial obliteration of the sinus plate on the involved side, with increased haziness and destruction of the cell wall outline. The petrous ridge appeared to be intact.

A pediatric consultation led to scheduling the child for a mastoidectomy, since he was found normal and healthy except for the mastoiditis.

A simple mastoidectomy was performed the next day and disclosed a necrotic mastoid with necrotic tissue in the antrum. The patient received the described postoperative care with sulfathiazole and left the hospital after seven days. The ear was dry by the fifteenth day and remained dry over the year in which I saw the child. He gained 9 pounds (4.1 Kg.) during that time.

CASE 4.—A female patient, 9 years old, was admitted to the children's surgical ward of the Graduate Hospital on my referral on Aug. 26, 1942. The diagnosis was acute exacerbation of a chronic infection of the right mastoid. There had been frequent pain and discharge from the right ear for the past year according to the history. The patient came in because of great pain in the ear following swimming.

She was a well developed child, ambulant when admitted. There were no gross abnormalities. The right ear had a discharge, and there were pain and tenderness over the antrum and tip. In other respects the results of the physical examination were negative. The urine and blood were examined and found essentially normal.

Roentgen examination of the mastoid showed it to be sclerotic on the right side, possibly as a result of previous mastoid infection in this region. The sinus plate, occupying the median position, was also sclerotic. Several small cells were seen lying immediately anterior to the sinus plate on this side. The possibility that active infection was present could not be excluded because of the sclerotic mastoid. The tip was normal.

A simple mastoidectomy, performed the next day, disclosed purulent secretion in the antrum with a sclerotic mastoid. The patient was given the described postoperative care with sulfathiazole. On the fourth day, submaxillary adenitis developed which was attributed to a deciduous left lower first molar containing a temporary cement filling. The first permanent first molar was loose and much involved in the infective process. Both molars were extracted with the patient under vinethene anesthesia. Sulfathiazole was given by mouth for the adenitis. The patient then had an uneventful recovery. The ear was dry, and the submaxillary cellulitis had subsided on the twelfth postoperative day, at which time she left the hospital.

CASE 5.—A male patient, 58 years old, was admitted to the otolaryngologic ward of the Graduate Hospital on July 11, 1942, with a diagnosis of acute suppurative mastoiditis. The patient stated that he had felt a pain in his left ear some two weeks previous, after having had a bad cold in the head. The cold had been treated conservatively by his physician for two days, and then a myringotomy had been performed, releasing a purulent discharge which continued for a week. The pain was relieved, but tinnitus persisted and the hearing was impaired. The patient stated that the pain in the left ear reappeared, accompanied with a septic temperature, a few days after the myringotomy.

He then came into the ward. He was not in acute distress. His physical examination revealed nothing abnormal except for the profuse drainage of the left ear. Landmarks were not visible, and there was postauricular tenderness. His blood and urine were essentially normal. Roentgen examination of the left mastoid showed the presence of generalized haziness. A small area, about 1 cm. in diameter, above the inferior portion of the sinus plate, had indistinct cell wall outlines and was apparently a site of localized destruction of bone, possibly involving the sinus plate.

The simple mastoidectomy indicated was performed. At the time of operation, the mastoid bone was found to be necrotic, but the sinus plate was intact. Sulfathiazole was used as described in this paper. The postoperative course was uneventful, and the patient left the hospital on the seventh postoperative day. Although the ear was moist at the time, there was no discharge, and a smear showed some pus cells but no organisms and no growth. According to reports of the physician who had originally referred the patient and who followed the case after the period of hospitalization, the ear was dry within fifteen days and remained so.

CASE 6.—A male patient, 47 years old, was admitted to the otolaryngologic ward of the Graduate Hospital Aug. 11, 1942. The diagnosis was chronic necrotic mastoiditis and postoperative fistula. The patient stated that he had had a draining ear for the last ten years. A simple mastoidectomy had been performed in 1933. The discharge did not stop then, and the patient was given conservative treatment at different times prior to coming to the Graduate Hospital. He described

what must have been attacks of vertigo and tinnitus over a six month period preceding his admission. I found that there was profuse drainage, thick and with a foul odor, from the previously mentioned postoperative fistula. His hearing had become progressively worse, he said.

The patient was in good health, according to his statement, and did not suffer undue discomfort at the time he came to the ward.

Results of examinations of urine, blood and blood serum were essentially normal.

Roentgen examination of the mastoid verified the history of a previous mastoidectomy on the right side. There were haziness in the few cells still visible and slight irregularity in the anterior sinus plate which seemed to indicate present activity.

A radical mastoidectomy was performed. During the operation purulent secretion was found in the remaining mastoid cells and in the tip, with cholesteatoma in the epitympanic space and antrum.

Sulfathiazole was used as described in detail in this paper. One-half hour postoperatively a facial palsy developed; it was attributable to the tight packing used (3 drachms, 11.65 Gm., of sulfathiazole powder and packing). The packing was removed immediately, but the powder was left in place. Three days later the patient was given a test with faradic current which disclosed that the nerve was intact and that the still existing palsy was due to the edema of the facial nerve sheath in the canal. At the time he left the hospital on the twelfth postoperative day, the patient was able to close the eye to a fair degree and to whistle slightly. In three months, recovery was complete. The tinnitus and vertigo had ceased, and the hearing had improved slightly. The ear was moist for two weeks after his discharge but dried at that time and remained dry.

CASE 7.—A male patient, 20 years old, was admitted to the otolaryngologic ward of the Graduate Hospital June 8, 1942 with the diagnosis of chronic mastoiditis with cholesteatoma. The patient gave a history of having had a discharge of the ear for the previous ten years, with draining at first intermittent but for the past two years continuous. His hearing had diminished, but he did not complain of vertigo, tinnitus, nausea or vomiting.

Physical examination revealed essentially normal conditions except for the left ear; on otoscopic examination it was observed that there was no tympanic membrane, that granulation tissue was profuse and that there was a foul granular discharge suggesting cholesteatoma.

This was verified, since gross findings at the time of the radical mastoidectomy, performed on June 11, revealed cholesteatoma in the epitympanic space and in the antrum. Sulfathiazole was used as described in this paper. The postoperative course was uneventful, and the patient left the hospital on the seventh postoperative day. The ear was completely dry in three weeks, and hearing was much improved.

CASE 8.—A 15 year old male patient was admitted to the otolaryngologic ward of the Graduate Hospital on June 30, 1942. He complained of a lump back of the left ear. He had had many attacks of otitis media on the left side and three years previously had had a simple mastoidectomy on the left side for a chronic discharge of five years' duration in that ear. Several months after this mastoidectomy, the patient noted, behind his left ear directly over the scarred area, a swelling which was somewhat painful on touch and which disappeared with aspiration. Since that time the swelling had reappeared a few times and had been drained. The last swelling occurred within the week before the [illegible] entered the hospital.

The patient was not in acute distress when admi[illegible] His physical examination revealed essentially nor[illegible] conditions except for the pathologic condition of [illegible] left ear. Otoscopic examination of that ear sho[illegible] the absence of tympanic membrane. There were fri[illegible] bleeding granulations and a mucopurulent and foul [illegible] charge, with tissue suggesting cholesteatoma. In a[illegible] tion, there was a small postauricular sinus, and m[illegible] erate tenderness was elicited over the antrum, body [illegible] tip of the left mastoid.

The results of the examinations of the urine [illegible] blood were essentially negative. Roentgenologic exa[illegible] nation, as reported by the referring physician, sho[illegible] acute exacerbation of a chronic mastoid infection w[illegible] possible evidence of cholesteatoma.

The gross findings at the time of the operation v[illegible] fied the presence of cholesteatoma, especially aro[illegible] the sinodural angle and the antrum. The dura c[illegible] tained a large quantity of granulation tissue. The radi[illegible] mastoidectomy and sulfathiazole therapy have been [illegible] scribed in this paper. The postoperative course w[illegible] uneventful, and the patient was discharged on the si[illegible] postoperative day. The ear had dried at the end of [illegible] second week and remained dry, according to the rep[illegible] of the referring physician, who followed the patie[illegible] progress for one year.

CASE 9.—A male patient, 25 years old, was admit[illegible] to the otolaryngologic ward of the Graduate Hosp[illegible] on Dec. 18, 1942. The diagnosis was chronic supp[illegible] ative mastoiditis. He complained of a foul discharge [illegible] the left ear of from eight to ten years' duration. Sho[illegible] before his admission, he became aware of progress[illegible] deafness with tinnitus.

Physical examination showed nothing abnormal. O[illegible] scopic examination revealed that only the head and n[illegible] of the malleus were present and only a small rem[illegible] of Shrapnell's membrane. The middle ear was fil[illegible] with granulation tissue, and the discharge was prof[illegible] and offensive.

The urine, blood and blood serum were norm[illegible] Roentgen examination revealed a sclerotic mastoid w[illegible] possible cholesteatoma in the antrum.

The radical mastoidectomy, performed on Decem[illegible] 20, did not disclose cholesteatoma but did reveal a sc[illegible] rotic mastoid with a necrotic tip. Sulfathiazole w[illegible] used as described in this paper. The postoperat[illegible] course was uneventful. The patient left the hospital [illegible] the fifth postoperative day. The ear became thorou[illegible] dry in seventeen days from the time of the operat[illegible] The tinnitus disappeared, and hearing improved.

CASE 10.—A 16 year old male patient was admitte[illegible] the otolaryngologic ward of the Graduate Hospital [illegible] June 20, 1942. The diagnosis was acute perforat[illegible] zygomatic mastoiditis. The patient complained of sw[illegible] ing behind the ear, of pain and fever. A similar c[illegible] dition usually arose some two weeks after he had b[illegible] swimming, he said. Pain would cease with the purul[illegible] discharge, but the swelling behind the ear would pers[illegible] He was treated conservatively at such times, but t[illegible] pain recurred periodically. At the time of admiss[illegible] the ear was not obviously discharging, but there w[illegible] pain and postauricular swelling.

Physical examination showed no abnormal condit[illegible] with the exception of discharge from the right ear a[illegible] an acute inflammation of the external auditory ca[illegible] The tympanic membrane had a small perforation in t[illegible] superior posterior quadrant. The postauricular swell[illegible] extended to and over the zygoma. There was p[illegible] nounced tenderness.

The urine, blood and blood serum were normal. The simple mastoidectomy and treatment described in detail in this paper were carried out. A perforation in the cortex of the zygoma was noted, with purulent secretion and necrotic bone in the antrum and zygoma. The patient made an uneventful recovery and left the hospital on the ninth postoperative day. The ear was thoroughly dry in two weeks after the operation. In four weeks the tympanic membrane appeared intact, with evidence of all the landmarks. Postoperatively the patient was given sulfathiazole by mouth for one week.

CASE 11.—A male child 3 years old was admitted to the otolaryngologic ward of the Graduate Hospital on June 7, 1942 with a foul discharge from the left ear. The mother of the child stated that the condition developed after an attack of measles when the boy was 2 year old. At the time of admission, the patient was restless and feverish.

Physical examination revealed nothing abnormal except hypertrophied and diseased tonsils and the pathologic condition of the right ear. The patient appeared undernourished.

The urine and blood were normal. Roentgen examination showed the right mastoid to be sclerotic, and there was radiolucency in the cells beneath the tympanum which seemed due to beginning abscess formation. Irregularity of the anterior sinus plate, occupying the median position, seemed to imply a break through the walls of the bone here, or it might have been due to the overlying shadows. The mastoid had all the characteristics of chronic mastoiditis in which destruction had set in. Active infection also seemed probable.

Bacteriologic examination and cultures from the mastoid cells revealed Staphylococcus albus and hemolytic and nonhemolytic streptococci.

The simple mastoidectomy disclosed a sclerotic mastoid with necrotic tissue in the antrum. The sinus plate was intact. Sulfathiazole treatment, as described in detail, was included. The patient made an uneventful recovery and left the hospital on the ninth postoperative day. The ear was treated for the following three weeks, until the end of which time it became dry. An infection of the ear following acute nasopharyngitis set in two months after the operation, but this was arrested. There was no recurrence of otorrhea following this infection of the upper respiratory tract. The patient was observed for one year following the operation, during which time the ear remained dry.

SUMMARY AND CONCLUSION

This study of mastoidectomies, in which sulfathiazole was used locally during the operation and postoperatively, has proved the effectiveness of the drug. Sulfathiazole was used in all cases at the time of operation, followed by postoperative use of a 5 per cent solution of sulfathiazole in drops for the ears. Patients selected at random, with pathologic symptoms lasting from six months to fifteen years and ranging in age from 2 years to 58 years, all recovered from the routine exposure of the dura and lateral sinus with no undue complications such as might have been anticipated before the use of sulfathiazole.

With the use of sulfathiazole, hospitalization postoperatively was greatly reduced, since infection and complications were at a minimum or did not arise.

In none of these cases were there intracranial complications or a fatality.

The unsatisfactory results obtained when sulfathiazole was used locally prior to operation for a control group of patients with otorrhea prove that the drug alone is not a cure-all. It does not reach the diseased mastoid cells when it is insufflated into the middle ear. Also, it must have a medium in which it can act as the bacteriostatic factor that it is. Since the middle ear and mastoid bone when diseased are essentially bone loci with a notably poor blood supply and therefore do not form a favorable environment for sulfathiazole, it is only when the inciting focus, or necrotic bone and tissue, is removed that the sulfathiazole acts bacteriostatically.

In conclusion, I found that sulfathiazole when used locally during a mastoidectomy and postoperatively is most effective in combating infections usually associated with that operation; however, there must be complete exenteration of the necrotic bone and tissue. Complications are fewer or entirely absent, and length of hospitalization and convalescence are greatly reduced.

Sulfathiazole has been a wonder drug to the surgeon who, in spite of skill and antisepsis, was unable always to control mastoid infections and complications prior to its use.

LATE SECONDARY TONSILLAR HEMORRHAGE

I. STUDIES OF PROTHROMBIN AND VITAMIN K

HARRY NEIVERT, M.D.

NEW YORK

Tonsillectomy and adenoidectomy are not infrequently complicated by secondary hemorrhage occurring generally on the sixth or the seventh day. This bleeding is a nuisance for both the patient and the physician and occasionally may be serious. Until recently little was known etiologically concerning its occurrence. It was accepted as an unavoidable concomitant in a variable percentage of cases.

Of course, there are several factors which distinguish tonsillectomy and adenoidectomy from other surgical procedures. For instance, after no operation elsewhere in the body does the surgeon leave two or three broad, open wounds without protection, to heal by second intention, and then practically starve the patient because the pain precludes proper nutrition unless acetylsalicylic acid or some other analgesic drug is given continuously.

At the Pharyngology Research Laboratory of Columbia University, which was established through the efforts of Prof. John. D. Kernan, my co-workers and I have been conducting investigations of the causation and the prevention of late tonsillar hemorrhage. Certain components of the blood which may lead to a solution of the problem have been studied. A series of papers is in preparation in which we will discuss the known factors involved in clotting and healing. One of the reports—part II of this study—will be concerned with the evaluation of vitamin C.

Our endeavors were given a new impetus when we learned from Dr. Rudolf Singer, formerly of Vienna, Austria, now a captain in the Medical Corps of the Army of the United States that only in this country did he encounter co paratively frequent occurrence of late second hemorrhage—a phenomenon rarely obser abroad. Other otolaryngologists from Cent Europe, on interrogation, confirmed Capt Singer's experiences.

In a critical comparison of the preoperat and postoperative regimens used in this coun and abroad, just one difference seemed sign cant: Acetylsalicylic acid is extensively prescri in this country, as it also is in Canada and E land, whereas in Central Europe aminopyrine the drug of choice.

At first view, it was difficult to account fo hemorrhage-inducing effect of acetylsalic acid, but the complete absence of late second tonsillar hemorrhage in a series of patients op ated on by Dr. Singer and kept on an acet salicylic acid–free postoperative regimen ad credence to his surmise that the bleeding is duced by acetylsalicylic acid. Furthermore, this country some surgeons, without being aw of the implications, gave no acetylsalicylic a postoperatively, and they did not observe ble ings. Others used vitamin K empirically a claimed to have no hemorrhages.

These facts were substantiated when Link a co-workers [1] of the department of biochemis of the Wisconsin Agricultural Experiment S tion, at the University of Wisconsin, interes in problems remote from ours, showed t salicylic acid and sodium salicylate administe repeatedly or even in single doses, orally or int venously, induced hypoprothrombinemia in r kept on a ration low in vitamin K. The anim could be protected against this action of salic acid by administration of a vitamin K prepa tion.

More recently, the aforementioned hypop thrombinemic effect of salicylates has b reproduced in man by three independent grou

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From the Pharyngology Research Laboratory, Department of Otolaryngology, College of Physicians and Surgeons, Columbia University and Presbyterian Hospital.

Thesis submitted to the Faculty of the Graduate School of Medicine of the University of Pennsylvania, toward the requirements for the degree of Master of Medical Science (M.Sc. [Med.]) for graduate work in otolaryngology.

1. Link, K. P.; Overman, R. S.; Sullivan, W. Huebner, C. F., and Scheel, L. D.: Studies on Hemorrhagic Sweet Clover Disease, J. Biol. Ch **147**:463 (Feb.) 1943.

investigators. Rapoport, Wing and Guest,[2] of the University of Cincinnati, studied 15 children with rheumatic fever, in 8 of whom significant prolongation of prothrombin time was observed following the administration of sodium salicylate (2 were given acetylsalicylic acid instead). The authors raised the question whether or not the hemorrhagic tendency occasionally present in rheumatic fever may be a concomitant effect of salicylate therapy.

Meyer and Howard,[3] of the University of Wisconsin, studied 31 adults, of whom about a fourth were normal persons, and arrived at the following conclusions:

1. The oral administration of acetylsalicylic acid and sodium salicylate to human beings in daily doses of 60 to 80 grains (1.3 to 5.3 Gm.) consistently produced hypoprothrombinemia and hypocoagulability of the blood.

2. The administration of vitamin K with the salicylate prevented the development of hypoprothrombinemia and prolongation of the coagulation time.

3. It is theoretically possible that the not unusual hemorrhagic manifestations of acute rheumatic fever may be due in some cases, at least in part, to the large doses of salicylates so commonly administered.

Finally, Shapiro, Redish and Campbell,[4] of New York University, demonstrated that both sodium salicylate and acetylsalicylic acid are capable of producing hypoprothrombinemia in adults and that this condition can be prevented by concurrent administration of vitamin K.

These facts throw light also on our particular problem of late post-tonsillectomy bleeding and its causation. Hypoprothrombinemia interferes with coagulation. Thus it is altogether possible that after salicylate medication—which has been shown to produce hypoprothrombinemia—a comparatively high incidence of secondary hemorrhage may be seen in patients who have undergone tonsillectomy, whereas the acetylsalicylic acid–free postoperative routine may not be accompanied by such after-effects.

In order to substantiate this postulate, estimations of prothrombin time were done for a large number of persons. In doing these Dr. Engelberg, our biochemist, who has cheerfully assumed the burden of the immense amount of analytic work entailed, has been employing the Page[5] method. According to this technic, viper venom[6] and calcium chloride are added to plasma obtained by centrifuging the decalcified venous blood. The sharp end point is characterized by the formation of fibrin particles clearly visible in the agitated test tube. A prothrombin time of from seventeen to twenty-four seconds is considered normal, according to the Page technic.

Our investigation revealed that in some subjects a total daily dose of 2.4 Gm. of acetylsalicylic acid will produce an elevation in prothrombin time on the very next day, whereas in others it will be much longer before a significant rise will be discernible—but, most assuredly, such a rise will occur eventually. For instance, in one experiment it was shown that no change of the control prothrombin time (fifteen to sixteen seconds) was produced after a daily dose of 2.4 Gm. of acetylsalicylic acid had been taken in divided doses for two days. However, continuation of the medication for another two and a half days resulted in a prothrombin time of thirty-two seconds. It seems that the promptness of response depends on the nutritional intake and the reserves of vitamin K of the subject.

These studies afford corroboratory evidence for the observation of the aforementioned investigators that administration of salicylates results in hypoprothrombinemia. If acetylsalicylic acid is an etiologic factor in the occurrence of late post-tonsillectomy hemorrhage, it would seem logical to eliminate it from the postoperative routine. In view of the fact, however, that acetylsalicylic acid, by virtue of its effectiveness and its comparative nontoxicity, is the most widely used analgesic, we thought it advisable, rather than to eliminate it, to combine it with an agent which will counteract its effect on prothrombin. We have proof that the water-soluble vitamin K–like compound synkayvite[7] (tetrasodium 2-methyl-1,4-naphthohydroquinone diphosphoric acid ester) prevents this undesirable side-effect of acetylsalicylic acid. Chart 1 shows both the procedure employed in evaluating the effect of the vitamin K–like compound in controlling the

2. Rapoport, S.; Wing, M., and Guest, G. M.: Hypoprothrombinemia After Salicylate Administration in Man and Rabbit, Proc. Soc. Exper. Biol. & Med. **53**:40 (May) 1943.

3. Meyer, O. O., and Howard, B.: Production of Hypoprothrombinemia and Hypocoagulability of Blood with Salicylates, Proc. Soc. Exper. Biol. & Med. **53**: 34 (June) 1943.

4. Shapiro, S.; Redish, M. H., and Campbell, H. A.: Studies on Prothrombin: IV. The Prothrombinopenic Effect of Salicylate in Man, Proc. Soc. Exper. Biol. & Med. **53**:251 (June) 1943.

5. Page, R. C.; DeBeer, E. J., and Orr, M. L.: Prothrombin Studies Using Russell Viper Venom: Relation of Clotting Time to Prothrombin Concentration in Human Plasma, J. Lab. & Clin. Med. **27**:197 (Nov.) 1941.

6. The viper venom was supplied by Burroughs Wellcome and Company.

7. The synkayvite and the experimental rectal suppositories employed in the course of our work were supplied by Hoffmann-La Roche, Inc. This company also furnished experimental tablets composed of acetylsalicylic acid and synkayvite.

prothrombinopenia induced by acetylsalicylic acid and the results obtained.

Patient G. P. with a prothrombin time of eighteen and eight-tenths seconds was given 2.4 Gm. of acetylsalicylic acid a day by mouth in four divided doses with no rise of his prothrombin time on the next morning. Another 2.4 Gm. of this drug on the following day elicited a rise of the prothrombin time to thirty-two seconds. The medication with acetylsalicylic acid was discontinued, and subsequent prothrombin assays showed that it took five days for the prothrombin time to approximate its original control value. Then, in order to determine the effect of rectally administered acetylsalicylic acid on the prothrombin time, three special suppositories containing 0.6 Gm. of acetylsalicylic acid each were given to the patient. The prothrombin time estimated on the next morning had risen to thirty-two seconds. After four more days the prothrombin time had not yet returned to normal but it was down to twenty-two and four-tenths seconds, and we decided to evaluate oral medication with acetylsalicylic acid and synkayvite combined. A total daily dose of 1.2 Gm. acetylsalicylic acid and 20 mg. of synkayvite, in four divided doses, was given by mouth for two days with the result that the prothrombin time dropped to seventeen and six-tenths seconds, which was lower than the original control value. Six days later three special rectal suppositories, each containing 0.6 Gm. of acetylsalicylic acid and 10 mg. of synkayvite, were administered within twelve hours, with a prothrombin time of twenty-two and five-tenths seconds resulting on the next morning.

Three days afterward the experiment with rectal administration of acetylsalicylic acid and synkayvite combined was repeated, but three suppositories were given on each of two consecutive days. The prothrombin time on the next morning was twenty and six-tenths seconds. We can thus say that synkayvite by either oral or rectal administration controls the prothrombinopenia induced by acetylsalicylic acid.

The experiments described so far were carried out in normal subjects or in patients who were hospitalized for conditions other than those requiring tonsillectomy. The next step was to establish, on the one hand, the effect of acetylsalicylic acid alone and, on the other, the effect of acetylsalicylic acid and synkayvite combined

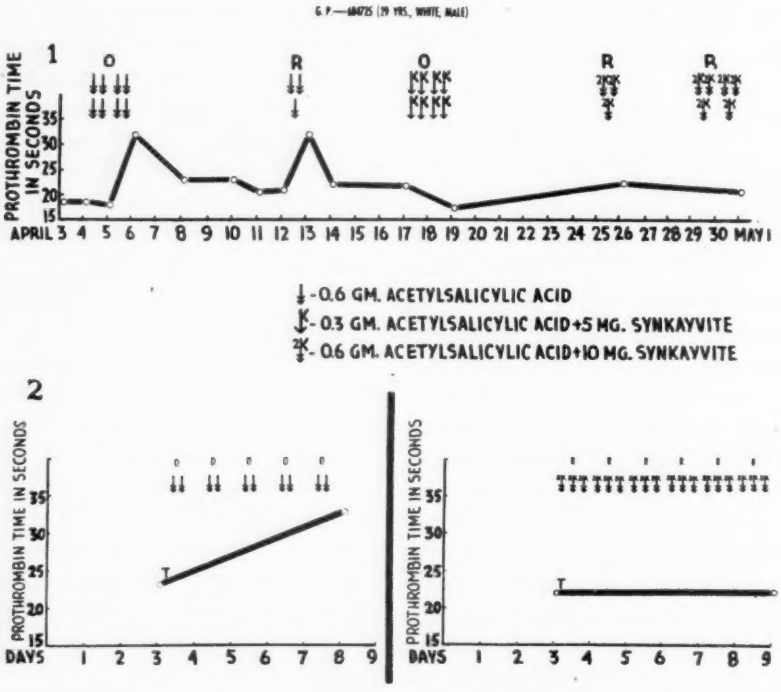
G. P.—68075 (29 YRS., WHITE, MALE)
1
O
R
O
R
R
PROTHROMBIN TIME IN SECONDS
35
30
25
20
15
APRIL 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MAY 1
↓-0.6 GM. ACETYLSALICYLIC ACID
K↓-0.3 GM. ACETYLSALICYLIC ACID+5 MG. SYNKAYVITE
2K↓-0.6 GM. ACETYLSALICYLIC ACID+10 MG. SYNKAYVITE
2
PROTHROMBIN TIME IN SECONDS
DAYS 1 2 3 4 5 6 7 8 9
↓-0.6 GM. ACETYLSALICYLIC ACID
2K↓-0.6 GM. ACETYLSALICYLIC ACID +10 MG. SYNKAYVITE

Chart 1.—Curve of prothrombin time recorded for subject G. P., a white man 29 years of age. After oral (*O*) and rectal (*R*) administration of acetylsalicylic acid and after acetylsalicylic acid–synkayvite medication.

Chart 2.—Curves of prothrombin time recorded for 2 tonsillectomized patients (E. S., a white woman aged 23 years, and M. Z., a white woman aged 48 years) when tonsillectomy was followed by medication with acetylsalicylic acid (left side of dividing line) and when it was followed by medication with acetylsalicylic acid and synkayvite combined (right side of dividing line). *T* indicates day of tonsillectomy; *O*, oral administration; *R*, rectal administration.

the prothrombin level of the patient who had undergone tonsillectomy.

Estimations of prothrombin time were done preoperatively for a number of patients. When they were discharged twenty-four hours after tonsillectomy, they were given our old instruction sheets calling for the use of acetylsalicylic acid tablet and chewing gum form for relief of pain. Five to seven days after operation the majority of them showed a significant rise in prothrombin time.

A second group of patients, whose prothrombin levels were also determined preoperatively, were given on the day of operation three to four rectal suppositories containing:

Acetylsalicylic acid	0.6 Gm.
Codeine phosphate	0.03 Gm.
Synkayvite	10 mg.

(For children we used the same formula but codeine phosphate was reduced to 0.015 Gm.).

All precautions were taken so that patients would not ingest acetylsalicylic acid or compounded powders which might contain a derivative of salicylic acid and that they would not chew gum containing acetylsalicylic acid or gargle with this analgesic either during their hospitalization or at home. We had to be certain that the only acetylsalicylic acid which they took was that with the suppositories, which contain a sufficient dose of synkayvite to guard against any prothrombin-lowering effect of the acetylsalicylic acid. Each patient was given on discharge a number of suppositories enabling him to continue medication as needed.

These patients on reexamination, five to seven days postoperatively, if they showed any rise of prothrombin time at all, certainly did not exhibit a reduction of prothrombin which could possibly interfere with normal coagulation.

Chart 2 shows 2 representative cases: Patient S. preoperatively had a prothrombin time of twenty-three and eight-tenths seconds. She took four tablets of acetylsalicylic acid, 0.3 Gm. each, a day, and on reexamination, on the fifth postoperative day, her prothrombin time was up to thirty-three seconds. Patient M. Z., on the other hand, with a preoperative control prothrombin time of twenty-two and two-tenths seconds, received three acetylsalicylic acid–synkayvite suppositories a day, and her prothrombin level, as portrayed in the graph on the right side of chart 2, did not change at all; on reexamination it was twenty-two and four-tenths seconds.

Not all patients displayed such marked elevation of the prothrombin time after several days' intake of acetylsalicylic acid, nor did all exhibit such unique constancy of the prothrombin time after the administration of acetylsalicylic acid and synkayvite together, as is shown in these two graphs. But it can be stated that in most post-tonsillectomy patients, acetylsalicylic acid in doses by no means excessive will lower the prothrombin markedly, whereas if synkayvite is administered simultaneously, no such reduction of prothrombin, essential for normal blood clotting, will occur.

On the basis of these laboratory findings we decided to evaluate the combined acetylsalicylic acid–synkayvite medication clinically on a broader scale. We employed both the rectal suppositories (formula already given) and the tablets composed of 0.3 Gm. (5 grains) of acetylsalicylic acid and 5 mg. of synkayvite. Two of these tablets, it was believed, would give a satisfactory analgesic effect and at the same time afford full protection against the prothrombinopenia induced with acetylsalicylic acid. Furthermore, it appeared that such combined oral medication would have an advantage over the administration of acetylsalicylic acid and synkayvite in individual tablets. Thus far we have given the suppositories to 173 and the combined tablets to 110 patients. Results were most gratifying, with only 4 patients troubled by late tonsillar bleeding among these 283 patients,[8] an incidence of 1.4 per cent. Incidentally, one of the late hemorrhages encountered in this series occurred in a 6-year old child in whom the bleeding undoubtedly was due to thumb sucking. She always created a powerful suction action as she withdrew the thumb from her mouth.

When compared with an incidence of late tonsillar hemorrhages of almost 10 per cent accompanying our former routine, which called for the free use of salicylates alone, our present results demonstrate that proper postoperative care should include measures designed to prevent lowering of the prothrombin content of the blood. Therefore, either salicylates will have to be avoided religiously or they will have to be combined with a drug such as synkayvite which prevents hypoprothrombinemia.

There is no justification, we believe, for looking on acetylsalicylic acid in general as a dangerous drug. It is not a common cause of hemorrhage in man, as proved by the many millions of doses of the drug taken with impunity every year. But when a wound is healing by second intention, such as that following tonsillectomy, a hypoprothrombinemic state should be avoided.

We also do not believe that the prothrombinopenia induced by acetylsalicylic acid must in

8. This figure includes also patients operated on since this paper was read before the Section on Otolaryngology of the New York Academy of Medicine.

all cases lead to secondary post-tonsillectomy bleeding. If this were so, physicians would see many more hemorrhages. Undoubtedly, there are other important factors in the causation of late post-tonsillectomy bleeding. For instance, it has been demonstrated that vitamin C is essential in normal healing of wounds. When plasma levels of ascorbic acid are below the lower normal limit, wound repair will be interfered with. Abnormalities in the distribution of the blood vessels supplying the tonsils, as well as excessive trauma at operation, are also sometimes accountable for hemorrhages. Menstruation, pregnancy, nutritional deficiency, disease of the liver, blood dyscrasia, syphilis and infection of the tonsillar fossae are known to be conditions which may favor postoperative bleeding. It is conceivable that in some cases only the concurrence of several factors predisposing to hemorrhage would precipitate the bleeding. But if one causative factor of such importance as a deficiency of prothrombin can be eliminated, the other factors may be insufficient to cause hemorrhage. A striking example of the importance of counteracting the prothrombinopenia-inducing effect of acetylsalicylic acid is offered by the following incidents: Two patients who had received postoperatively for several days a number of suppositories purportedly containing acetylsalicylic acid and synkayvite bled profusely. Analysis of the suppositories revealed that they did not contain synkayvite as prescribed, the druggist having inadvertently omitted synkayvite in making them up. Consequently these patients had received co paratively large doses of salicylate without t benefit of the action of the vitamin K–like co pound. The fact that both bled constitu corroboratory evidence in support of the w presented.

SUMMARY

While in rare cases the cause of late po tonsillectomy hemorrhage may be trauma, me struation, infection, deficiency of vitamin C some blood dyscrasia, our observations to da suggest that one of the most important factors a reduction in the prothrombin of the blo brought about by the use of acetylsalicylic acid salicylates. The hypoprothrombinemia interfe with coagulation. However, with the simu taneous administration of a vitamin K–like co pound (synkayvite) the prothrombin-lower effect of acetylsalicylic acid will be overcome a consequently normal coagulation can take plac

Prof. John D. Kernan made it possible for us embark on this investigation. Dr. Leo A. Pirk, Hoffmann-La Roche, Inc., helped me plan and exec the investigative work presented. The head nur Miss Ethel Nord, collaborated.

555 Park Avenue.

9. The author requests data on the causes of h tonsillar hemorrhage as observed by other otolar gologists. Any information furnished should be sent him in care of the Pharyngology Research Laborato College of Medicine, Columbia University, 630 W 168th St., New York.

ACETYLSALICYLIC ACID, A PROBABLE CAUSE FOR SECONDARY POST-TONSILLECTOMY HEMORRHAGE

A PRELIMINARY REPORT

CAPTAIN RUDOLF SINGER

MEDICAL CORPS, ARMY OF THE UNITED STATES

The post-tonsillectomy healing process is characterized by a reactive inflammation with healing by second intention. As a clinical complication, bleeding, sometimes of a dangerous nature, may occur. This postoperative hemorrhage is classified as either primary or secondary. The former, rarely encountered, arises within the first twenty-four hours after operation and originates from a small spurting artery or a small oozing vein; the latter occurs three to ten days postoperatively and is of the parenchymatous type. Thus, apart from those infrequent cases complicated by primary hemorrhage, two types of postoperative course may be observed: (*a*) the normal process of healing with reactive inflammation of a nonhemorrhagic nature, in which secondary hemorrhage does not occur, and (*b*) the abnormal process, exhibiting characteristic hemorrhagic inflammation of the soft palate and often complicated by secondary hemorrhage. The nature of the postoperative course is not influenced by the surgical method of removal, the type of anesthesia employed or the age or the sex of the patient.

In the normal postoperative course, the fossae may dry and, after eight to sixteen hours, become covered with a fibrinous membrane which, after one day, spreads over the entire wound, the margins of which have an inflammatory appearance. Occasionally the uvula becomes edematous. Pain increases during the first day and tends to abate on the second, but may become worse on the morning of the third day with some radiation into the ears before completely subsiding. On about the sixth postoperative day, the sloughing of the membranes commences, and the size of the wounds diminishes quite rapidly as the fossae appear lined with granulation tissue, often exhibiting a secondary and thinner membrane.

If the healing process is abnormal, the postoperative course of the first two days follows the same pattern as during the initial stage of the first type. However, on the third day a hemorrhagic inflammatory suffusion of the wound margins develops which, unaccompanied by pain, quickly progresses into the soft palate and the uvula. The margins of this suffusion are sharply defined and angular, seldom extending beyond the soft palate, and the membranes covering the fossae have a dirty gray appearance.

Frequently, on the sixth or the seventh postoperative day, after an attack of radiating pains, a secondary hemorrhage occurs. This bleeding is usually unilateral but may be bilateral or recurrent. Often it is severe in nature, with oozing from the granulations from which the membranes have sloughed off. This may require the use of any of the known hemostatic agents if the bleeding does not cease with the removal of the clot from the fossa. After the onset of secondary hemorrhage the radiating pains cease almost immediately. The suffusion in the soft palate disappears rapidly within one or two days, and only on the tip of the uvula a submucous hematoma persists for a number of days. From here on, the healing of the wound progresses normally. In my experience, the abnormal healing process with hemorrhagic inflammation of the soft palate occurs in about 30 per cent of all patients who have undergone tonsillectomy. Of these, secondary hemorrhage occurs as a complication in about 16 to 33 per cent. Thus secondary postoperative bleeding occurs in 5 to 10 per cent of all tonsillectomized patients.

The incidence of this complication is practically negligible in the operating clinics and hospitals of Central Europe; textbooks published in Central Europe do not mention it. Inasmuch as the methods of operation and the technics employed in this country and in Europe are the same, it appears obvious that the difference in the postoperative course is due to some other factor. It was at first assumed that the occurrence of secondary tonsillar hemorrhage was predicated on climatic or nutritional factors. However, on a comparison of the preoperative

This study was done before the author entered the service of the U. S. Army (1943).

and postoperative regimens used in this country and abroad, only one significant difference could be found. This was the administration in this country of acetylsalicylic acid to relieve postoperative pain. Here, routinely 10 grains (0.65 Gm.) of acetylsalicylic acid is given three or four times daily to the patient after tonsillectomy until such time as the patient is comfortable. In Central Europe acetylsalicylic acid is never used as a postoperative analgesic; aminopyrine is used instead.

Considering acetylsalicylic acid as being the etiologic factor of the hemorrhagic inflammation and secondary hemorrhage observed in so many patients, I completely eliminated the use of acetylsalicylic acid and salicylates postoperatively. In 75 patients observed during 1943 with an acetylsalicylic acid–free post-tonsillectomy routine, there was no secondary hemorrhage and, still more significant, not a single hemorrhagic inflammation of the soft palate. The postoperative course of the entire group followed the pattern described in a foregoing paragraph as the normal healing process.

COMMENT

There are several reports on record which prove that salicylic acid and some of its derivatives cause prothrombinopenia in animals and men. Link and co-workers,[1] experimenting with rats kept on a diet low in vitamin K, found that salicylic acid reduced the prothrombin in the blood of these animals. If given over a long period the salicylic acid produced hemorrhages. If vitamin K was administered simultaneously, prothrombinopenia did not occur. More recently Rapoport and associates,[2] Meyer and Howard [3] and Shapiro and associates [4] have duplicated these observations in man.

The prothrombinopenic effect of acetylsalicylic acid may afford, first, an explanation of the occurrence of late tonsillar bleeding in patients who had received this drug postoperatively and, second, an explanation of the abse of such hemorrhages when the administra of acetylsalicylic acid was avoided.

Honigsberger [5] showed that epistaxis c be produced by giving acetylsalicylic acid t child with no previous evidence of hemorrha tendency. An adult patient of his experien nosebleed regularly following the ingestion acetylsalicylic acid for headache. The prothro binopenia induced by acetylsalicylic acid may the explanation for these phenomena.

Ersner and co-workers,[6] in 1934, in simple convincing experiments furnished evidence t acidification, as by acetylsalicylic acid, rende ineffectual the coagulatory properties of sali For this reason, they cautioned that "the ch ing of Aspergum or the use of aspirin mo washes and gargles should be avoided follow tonsillectomy."

The action of acetylsalicylic acid in preve ing blood coagulation as described by these vestigators is thus predicated on a mechani different from that of the action of inges acetylsalicylic acid, which by inducing hypop thrombinemia will interfere with coagulation

Investigations on a broader scale should firm establish the fact that acetylsalicylic acid, ow to its prothrombinopenic effect, is capable causing secondary hemorrhage from granulat wounds. Serious consideration has to be gi to this factor because of the widespread use salicylates as analgesics. The implications other fields of medicine, particularly in milit medicine and plastic surgery, are evident.

SUMMARY

Secondary hemorrhage, preceded by hem rhagic inflammation of the soft palate, is served as a complication of the post-tonsillecto course in a comparatively great percentage cases. A postoperative regimen free fr acetylsalicylic acid in a series of 75 cases resul in the conspicuous absence of hemorrhagic flammation and also of secondary hemorrh in all instances. The prothrombin-lowering fect of salicylates described by a number authors seems to be a plausible explanation the occurrence of secondary post-tonsillecto hemorrhage.

1. Link, K. P.; Overman, R. S.; Sullivan, W. R.; Huebner, C. F., and Scheel, L. D.: Studies on the Hemorrhagic Sweet Clover Disease, J. Biol. Chem. **147**:463, 1943.

2. Rapoport, S.; Wing, M., and Guest, G. M.: Hypoprothrombinemia After Salicylate Administration in Man and Rabbit, Proc. Soc. Exper. Biol. & Med. **53**:40, 1943.

3. Meyer, O. O., and Howard, B.: Production of Hypoprothrombinemia and Hypocoagulability of the Blood with Salicylates, Proc. Soc. Exper. Biol. & Med. **53**:234, 1943.

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6. Ersner, M. S.; Myers, D., and Ersner, W.: Clinical and Experimental Study of the Action of Sal on Blood Coagulation and Wound Healing in Surg of the Oral Cavity and Throat, Ann. Otol., Rhin Laryng. **43**:114, 1934.

CAUSES OF DEAFNESS IN FLYERS

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The pathologic and the clinical observations in cases of loss of hearing from airplane flight are the subject of this communication. The usual hereditary, vascular, toxic and bacterial causes of deafness are not considered unless modified by flying or flying machines.

DEAFNESS FROM DESCENT

Acute Type.—A frequent type of deafness from flight both among passengers and crew is the result of a change of pressure in the middle ear following improper function of the eustachian tube during and after descent. Failure to equalize the pressure in the middle ear results in injury to the mucosa of the middle ear. This has been called "otitic barotrauma" [1] or more properly "otic barotrauma." [2] Relative difference in pressure quickly produces suction on the mucosa of the middle ear and an inflammatory reaction; i.e., it produces traumatic otitis media. Since inflammation occurs, it is correct to designate this disease as otitis. Similarly, a blow on the eyeball is said to produce iritis or conjunctivitis.

If infection is present in the nasopharynx, the eustachian tube or the middle ear, and it often is without the patient being aware of it, otic barotrauma may produce suppurative otitis media. The syndrome of the injury and its sequelae, if any, will be called, wherever possible in this paper, "otitis media due to barotrauma." This will then be qualified by the words "hyperemic," "nonsuppurative," "suppurative," "acute," "chronic," "recurrent," "mild," "moderate" and "severe" as the case may be. For example, according to this nomenclature, the earliest phase of the disease would be called "otitis media, acute, hyperemic, mild, due to barotrauma."

Because this is cumbersome, although correct from the pathologist's point of view, the word "aero-otitis," used by Armstrong and Heim,[3] will often be substituted as a synonym for uncomplicated aural injury due to changes of tubotympanitic pressure sustained in aircraft. Similarly, the words "otic barotrauma" may be used to express the initial phase of the disease. The more lengthy term is necessary for classification purposes because if the effects of otic barotrauma and the word "aero-otitis" are not listed under the general term "otitis media," mistakes in determining the incidence of the disease and of its complications are bound to occur, since all physicians will not agree as to where traumatic inflammation ends and bacterial inflammation begins. Furthermore, the care of the flyer and the prognosis of his injury are dependent on the degree and the type of the otitis that develops, and it is these which should receive emphasis in records.

The clinical history of otitis media due to barotrauma is as follows: After a descent of a few thousand or sometimes a few hundred feet the ear acquires a "full" sensation if the patient has been unable to clear his eustachian tube. There is moderate deafness due to splinting of the ossicular mechanism. On further descent, pain may become severe, and finally the drum may rupture. The usual picture in the plane or on the ground immediately after descent is that of marked hyperemia, which is much more acute at first than after a few hours. Strangely, otitis media from barotrauma may occur without pain or apparent deafness. Dickson [1] found injected drums without symptoms in *27.7* per cent of flying cadets after a decompression test. By the time a patient has reached a hospital, the drum is found to be lusterless and the light reflex is distorted or narrowed, but the injection of the blood vessels may be decreased. It is usually present along the handle of the malleus, which is more or less retracted. Fluid often appears in the middle ear. This sometimes can be brought out

The sections used to illustrate this paper were prepared in paraffin by Sergeant M. Bressler under the direction of Lieutenant Colonel O. Murray Angevine in the General Medical Laboratory, European Theater of Operations.

1. Dickson, E. D. D.; McGibbon, J. E. G., and Campbell, A. C. P.: Acute Otitic Barotrauma, J. Laryng. & Otol. **58**:465 (Dec.) 1943.

2. Alexander, A. B., in discussion on Dickson, McGibbon and Campbell,[1] p. 493.

3. Armstrong, H. G., and Heim, J. W.: The Effect of Flight on the Middle Ear, J. A. M. A. **109**:417 (Aug. 7) 1937.

only by inflating the eustachian tube and then looking for bubbles. In most cases the fluid is serous and appears to be quite clear. Occasionally there are many red blood cells, and these may give a bluish sheen to the drum. Depending on the amount of blood and how much it breaks down, this blue can vary through all the shades of color seen in any ecchymosis. In a few hours to a few days the fluid disappears mainly by drainage through the eustachian tube. Bloody mucoid material can usually be seen coming from the orifice of the tube if a nasopharyngoscope is used to examine the region. How much of the transudate or exudate present is absorbed by the submucosa of the middle ear and of the cells of the mastoid bone and how much is removed by the ciliary action of the tube is debatable. It is certain that the ciliary action is the more important.

In a general hospital aero-otitis is most often bilateral. Of the 93 patients seen because of this disease in 1943, 74 (79 per cent) had bilateral involvement. Other authors record that aero-otitis is usually unilateral. Perhaps the reason is that the condition of one ear is often so mild that it causes no complaint.

Pain and exudation of fluid may not appear until several hours after flight. This is called "delayed aero-otitis" and is thought to be due to absorption of oxygen in high concentration, such as is used in high altitude flight. In the presence of blockage of the eustachian tube a relative vacuum is produced when the oxygen is absorbed, and submucosal swelling and effusion occur because of it. Otitis of this type has been observed on the ground following breathing of oxygen in high concentration.[4] Another theory for the occurrence of "delayed aero-otitis" is that the relative difference of pressure between the middle ear and the nasopharynx causes infected material to be sucked up the eustachian tube. This infected material produces otitis media some hours after the flight. Probably in some patients the disease is due to one cause, and in some, to the other.

Figure 1 is a picture of moderate otitis media due to barotrauma in the hyperemic stage. It shows a section of the temporal bone of a man who had no history of aero-otitis but died at 23,000 feet (7,000 meters) of anoxia. Of course, it is hard to know for certain whether he ever had clinical aero-otitis before death. The rather more than normal connective tissue suggests previous attacks of otitis media. The mucosa of the middle ear shows slight edema and much engorgement of vessels. Here and there throughout the middle ear and the cells of the mastoid bone are extravasations of blood submucosally, with occasional bleeding into cavities. The eustachian tube contains considerable mucus and a little blood, but it does not seem to be completely blocked. Pathologically, this is typical mild aero-otitis, and it resembles early acute nonsuppurative otitis media from an infection of the upper respiratory tract before much exudation takes place except for the prominence and irregularity of the vascular engorgement.

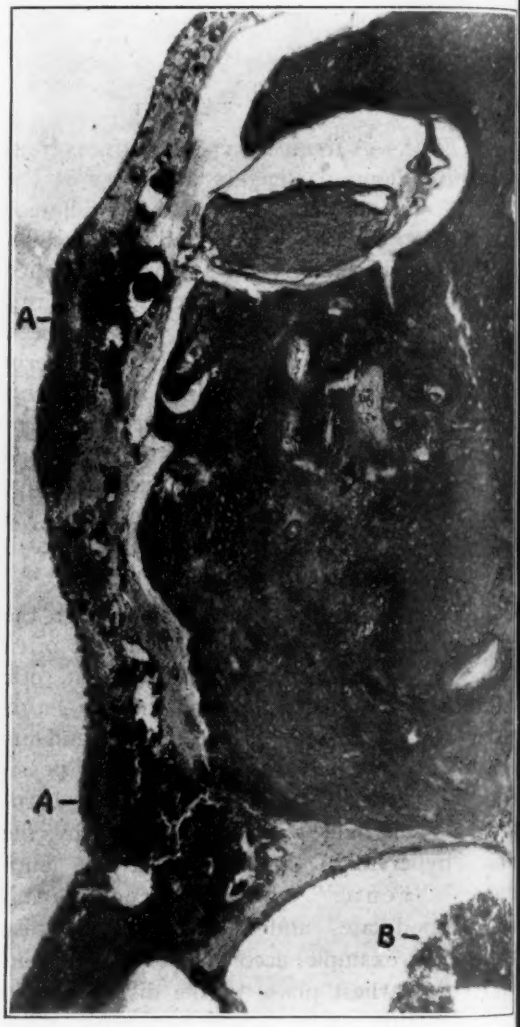


Fig. 1.—Otitis media due to barotrauma, acute hyperemic, moderately severe (aero-otitis). Note submucosal blood (*A*) and hemorrhage (*B*). Magnification, × 63. United States Army Medical Museum neg. no. 82622.

There is as a rule only slight deafness with aero-otitis. It is often transient (fig. 2). At first the low tones are involved more than the high; later the slope of the audiogram curve may reverse. If the deafness is due to fluid, even if the fluid does not completely fill the middle ear, it usually in-

4. Armstrong, H. G.: Principles and Practice of Aviation Medicine, Baltimore, Williams & Wilkins Company, 1943.

lves only the high tones, but if edema occurs ound the ossicles, it may involve the low tones. he airman occasionally complains that he is

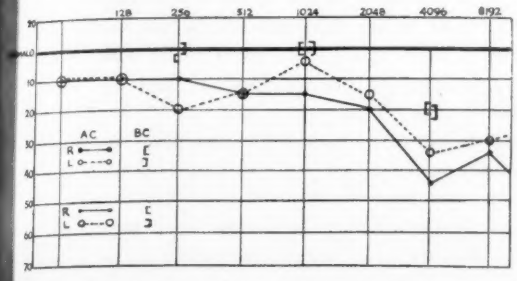


Fig. 2.—Audiogram of an aviator with aero-otitis enty-four hours after the barotrauma. Fluid was sent to the level of the umbo. There was slight raction and narrowing of the light reflex and slight ection of the vessels along the handle of the malleus. te that there is mild conduction deafness for the tones and somewhat more nerve deafness for the her tones.

not occur unless a suppurative otitis media supervenes.

It is an established fact that otitis media from barotrauma is due to failure to equalize properly the air pressure in the middle ear. Factors predisposing to and contributory to its production can be grouped roughly in the order of their importance as follows:

1. Deficient knowledge or carelessness about opening the eustachian tubes. This is especially prevalent in transport aircraft, both military and civil.

2. Descent while suffering from an infection of the upper respiratory tract, especially acute sinusitis or acute nasopharyngitis. The latter may develop during the course of a flight from long exposure to cold and wind.

3. Excess lymphoid tissue in or about the mouth of the eustachian tube (fig. 3). This of course becomes more swollen if an infection of the upper respiratory tract is present.

4. Previous otitis media, either acute or chronic. Those with a history of recent aero-otitis are particularly prone to recurrences. Sometimes the history is simply that of repeated earaches as a child.

5. Unconsciousness, due to sleep, anoxia, shock or drugs. Most often this occurs in ambulance planes, but occasionally it occurs in commercial aircraft.

6. Preoccupation with gunnery, evasive action or lack of control of the aircraft and consequent omission of the customary maneuvers for opening the tube. This is rarely found in experienced flyers.

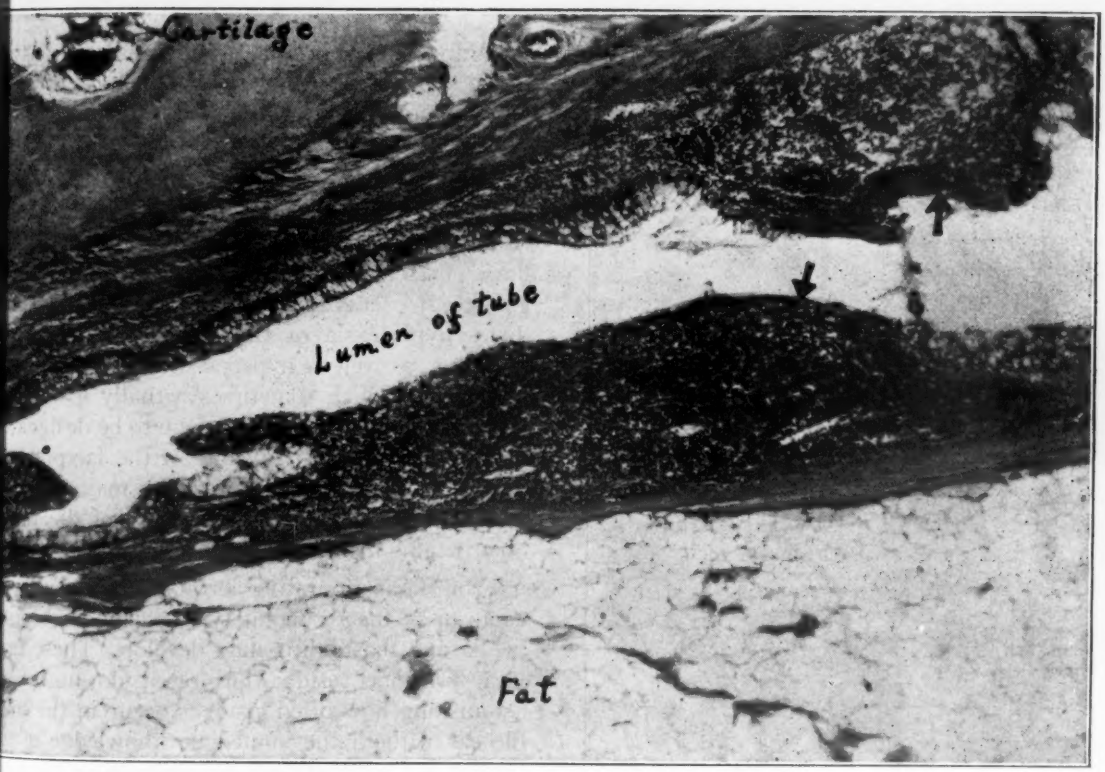


Fig. 3.—Lymphoid tissue in the middle third of the eustachian tube. A little more could block it. Magnification, × 72. United States Army Medical Museum neg. no. 82621.

afened when he holds his head in a certain sition, owing to fluid in the middle ear, or he mplains that he cannot hear the tick of his wrist tch or some such weak and relatively high-ched sound. Although deafness is usually the tient's chief complaint at first, loss of hearing any extent as measured by the audiometer does

7. Extremely rapid descent. This is not common except in those not used to it or not expecting it, unless some other factor is present.

8. Scarring of the mouth of the eustachian tube due to inexpert adenoidectomy or to tubal massage and edema due to bougienage or overzealous catheterization.

9. Septal spurs, or nasal polyps far back in the nose.

10. Allergic reactions in the nose and especially hypertrophied posterior tips on the inferior turbinate

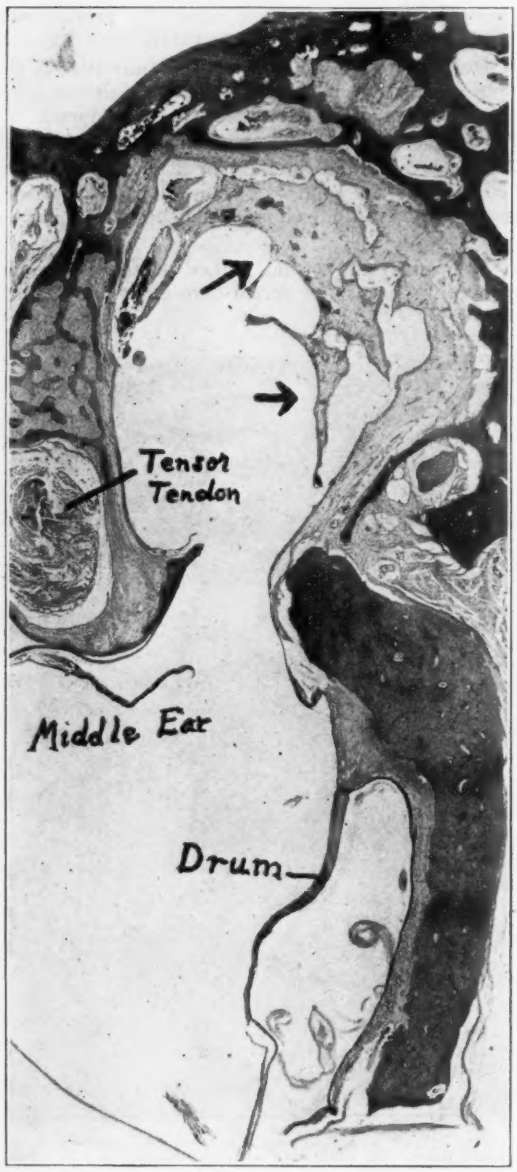


Fig. 4.—Excess granulation tissue (arrow) in the epitympanum of an aviator who had 400 hours' flying time but no history of otitis. Magnification, × 14. United States Army Medical Museum neg. no. 82624.

large enough to interfere with the passage of mucus around the torus tubarius. The tubes are themselves swollen at times in cases of severe sensitivity to pollen.

11. Hypertrophied tonsils. Such tonsils are occasionally said to interfere with the function of the tubes. As a rule, they merely indicate that lymphoid hyperplasia will also be found in the nasopharynx. The improvement sometimes occasioned by tonsillectomy is probably most often due to the improvement in a concomitant chronic infection of the upper respiratory tract. It is hard to see how the tonsils per se, unless extremely large, could have much to do with aero-otitis.

12. Tumors of the nasopharynx and the eustachian tubes.

13. Paralysis of the ninth and tenth nerves due to diphtheria, gunshot wound or disease of the spinal cord (e. g., multiple sclerosis).

14. Malocclusion. This has been mentioned[5] but must be rare as a cause of aero-otitis.

Recurrent Type.—Quite often, mild nonsuppurative otitis due to barotrauma becomes recurrent, and when it does it is more apt to last longer and become more severe than with a single attack. The drum is more retracted and tends to remain so. Deafness is more apt to occur and is more apt to last for several weeks or become permanent. The appearance of the drum suggests that the pathologic changes are probably like those seen in figure 4. There is a loose granulation tissue in the cavities of the middle ear and mastoid bone and the more this involves the ossicles the greater the deafness (fig. 5).

The forerunner of chronic or recurrent aero-otitis is usually chronic nasopharyngitis. With recurrent nasopharyngitis there develops secondary eustachian salpingitis; this stimulates the growth of excess lymphoid tissues (fig. 3), produces hyperplasia of the glands and excessive secretion, as well as hyperplastic flaps of mucous membrane, which sometimes actually grow to a size and a shape that permit them to be designated as polyps (fig. 6). Any one of the factors predisposing to mild acute aero-otitis may also precipitate a more severe form if any of the tissue obstructions mentioned are present.

From nonsuppurative aero-otitis, either of the acute or of the recurrent type, all kinds of otitis media and mastoiditis may develop. These may clear without residua but often do not. It is astonishing how often changes occur in the middle ear without the immediate knowledge of the patient and without definite suppuration. A great many test pilots and other airmen with many hours of flying in commercial fields have thickened and retracted drums and more or less conductive deafness. Armstrong reported this in 1934.[6] Repeated barotrauma apparently tends to favor the

5. Willhelmy, G. E.: Ear Symptoms Incidental to Sudden Altitude Changes, and the Factor of Overclosure of the Mandible, U. S. Nav. M. Bull. **34**:5 (Oct.) 1936.

6. Armstrong, H. G.: Our Present Physical Standards for Flying, J. Aviation Med. **5**:107 (Sept.) 193

elopment of subacute and chronic otitis media. s probable that these changes are more apt to e place in parts of the world where infections he upper respiratory tract are prone to occur if the airmen fly too soon after a severe ack of aero-otitis.

diagrams to illustrate the observations of Armstrong and others concerning the effect of changes of barometric pressure and give anatomic measurements of inestimable value in study of the eustachian tube.[7] Graves and Edwards' descrip-

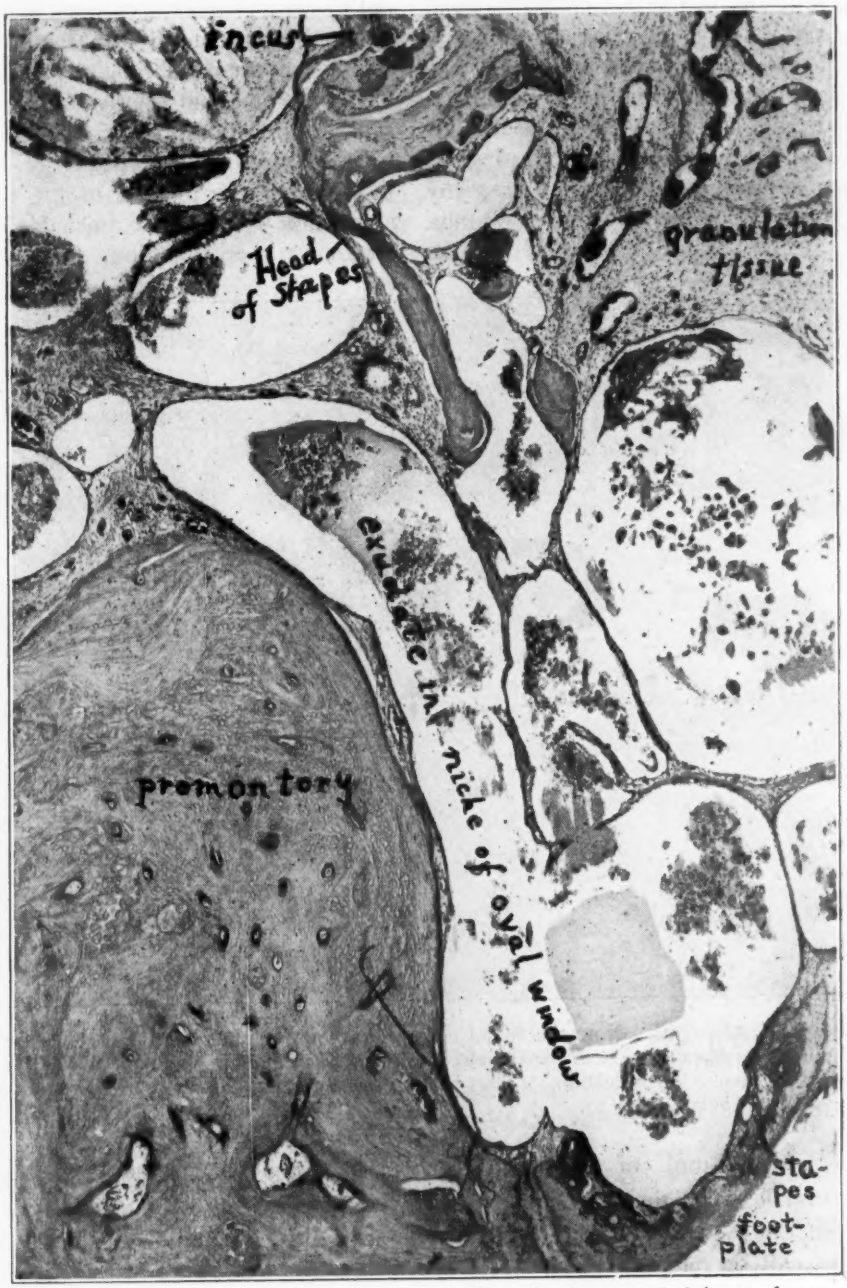


Fig. 5.—Adhesions around the stapes, with pockets of exudate, in the temporal bone of an aviator who had ne eleven operational missions over Europe at high altitude but who had never complained of his ears. The thologic process is that of chronic otitis media and must have caused deafness. Magnification, × 40. United ates Army Medical Museum neg. no. 82617.

Laboratory Findings in Cases of Deafness from escent.—For a clear understanding of the echanism of the production of aero-otitis from escent, the work of Dickson, McGibbon and ampbell [1] is instructive. They give excellent tion of the anatomy [8] also makes for understanding of many causes of blockage. According to

7. McGibbon, J. E. G.: Aviation Pressure Deafness, J. Laryng. & Otol. **57**:14 (Jan.) 1942.

(Footnotes continued on next page)

these studies, recurrent blockage of the tube may occur theoretically in any part of its length. It seems, however, to occur most commonly at the pharyngeal orifice. This is suggested by the fact that irradiation of the nasopharynx with relatively small doses of radium emanation clears the tube in a majority of the cases.[9] Since small doses were given, from which the radiant energy could not penetrate in any concentration to the isthmus of the eustachian tube, the obstruction must be near the nasopharynx; otherwise it could not be relieved by this amount of radiation. Farrior[10] has shown, furthermore, that many tubes which cannot be opened with 40 to 60 mm. of pressure by the Valsalva method can be opened with 3 or 4 mm. of pressure if a catheter is passed between the lips of the torus tubarius. From this he has concluded that the obstruction is usually at the pharyngeal orifice of the tube. My own observations with the same technic confirm the findings of Farrior. There is of course some question whether conclusions drawn from the use of the Valsalva maneuver are valid.

Study of anatomic sections shows that lymphoid tissue and thick secretions are most common about the pharyngeal orifice of the tube. Flaps of hyperplastic membrane can be found anywhere along the tube, but they would be most likely to cause obstruction in the oval bony end of the tube. It is possible that flaps of the type shown in figure 6 are present in the cases of severe aero-otitis which is not amenable to any form of treatment, even radiation. At any rate, it is probable that the disease is produced by the same etiologic agent in all cases.

Fig. 6.—Eustachian salpingitis. Note the round cells beneath the epithelium and in the base of the flaps of hypertrophied mucous membrane. These flaps could block the tube either in ascent or in descent if large enough and in the proper position. Magnification, × 80. Photograph by Mr. Hudson of the Department of Pathology, Cambridge University, England.

Since it is manifestly impossible to obtain easily temporal bones of human beings with histories of aero-otitis in all stages, it is necessary to study animal material for a better understanding of the sequence of events in the development of the condition. Campbell and co-workers worked with cats that were heavily anesthetized so that they did not swallow during the experiment. The cats were decompressed in a chamber to a pressure the equivalent of that of 20,000 feet (6,100 meters) and then recompressed

8. Graves, G. O., and Edwards, L. F.: Eustachian Tube: Review of Its Descriptive, Microscopic, Topographic and Clinical Anatomy, Arch. Otolaryng. **39**: 359 (May) 1944.

9. Fowler, E. P., Jr.: Use of Radon to Prevent Otitis Media Due to Hyperplasia of Lymphoid Tissue and Barotrauma (Aero-Otitis), Arch. Otolaryng. **40**: 402 (Nov.) 1944.

10. Farrior, B.: Personal communication to the author.

mal and killed at intervals varying from a few utes to twenty-four hours. The temporal es were then removed, embedded in celloidin concentrated pyroxylin) and sectioned. The st striking change in all the temporal bones edema and engorgement of the submucosa of middle ear. Depending to some extent on rapidity of descent there were also found peditic hemorrhages into the mucosa and ous or hemorrhagic effusion into the middle cavity.

Human material shows much the same sort of nges as the cats. A large percentage of the ticular airmen studied died of anoxia, which ld well be the cause of some of the submu- al hemorrhage which is so striking in all the ions. On the other hand, they died at high tude and, being dead, did not swallow during cent, so that the mechanism for otic baro- ma was present. Airmen who died of gun- t wounds at high altitude showed hemorrhage ilar to that found in those whose deaths were to anoxia. The hemorrhage tended to be common, less extensive and less severe than observed when death was due to anoxia, vever.

To ascertain whether the hemorrhage was due noxia or to the descent, 2 cats were killed Dickson, McGibbon and Campbell at 40,000 (12,190 meters) and 2 guinea pigs were d by Kritzler with pentobarbital sodium after hours without oxygen at 35,000 feet (10,660 ers). (This altitude is apparently not lethal cats and guinea pigs.) Autopsy of these ani- s in the pressure chamber before decompres- showed no gross hemorrhage, and the micro- ic sections of the guinea pig's temporal bones wed only a few inconsequential submucosal morrhages in one slide. This was in marked trast to what was seen when animals were d at 35,000 feet of altitude after exposure noxia and were then brought to ground level re being submitted to autopsy. The latter nals showed gross bleeding into the sub- osa and into the middle ear cavity, which ed analogous to the hemorrhage in human gs who died of anoxia while at high altitude were then examined some hours later on the und.[11] Much more work will have to be done animals and more human material with no ory of anoxia studied before this point con- ning the submucosal hemorrhage can be set- . It is probable that anoxia predisposes to e extensive hemorrhage when the ear is sub- d to barotrauma. The immediate pathologic condition should produce little deafness unless effusion or gross hemorrhage takes place in the middle ear. Submucosal swelling on the ossicles or their ligaments should hamper their movements little.

Chronic Conductive Type.—There are in addition to the acute changes noted in the foregoing pages certain permanent pathologic conditions to be found in the temporal bones of aviators who have had many hours of flying time, especially if they have been test pilots and have flown in open cockpit planes. After the animal experiments of Campbell and associates there is little question that the immediate effect of rapid recompression with a closed eustachian tube is submucosal edema, as well as engorgement of vessels and hemorrhage. After forty-eight hours there may be an increased number of fibrocytes in the submucosa as well as considerable round cell infiltration. In 4 of the 26 human bones examined, the middle ear cavity contained excess

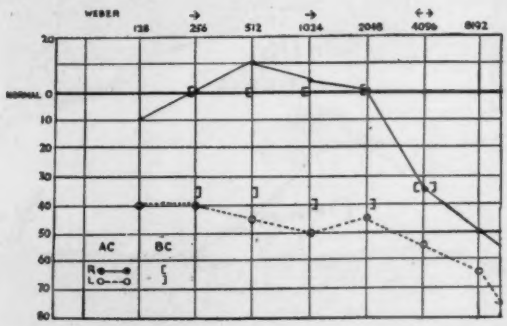


Fig. 7.—Audiogram of an aviator who suddenly became deafened in the left ear during a rapid descent. No pathologic condition was seen in the nasopharynx or the middle ear.

fibrous tissue (fig. 4), and in 1 case the entire cavity was filled with connective tissue containing pockets of inflammatory exudate (fig. 5). Thus 4 of 26 aviators had permanent changes in their middle ears suggestive of previous infection of the middle ear, and 2 had enough involvement to produce some deafness. It is impossible to embed the ossicles in tissue such as that shown in figure 5 without producing deafness. Whether the increase of fibrous tissue in these particular 4 airmen was due to flying is impossible to say. It may have been the result of previous infection of the middle ear. Certainly in the very severe cases there must have been a long-standing otitis media. None of these men went to sick call with complaints about their ears, and all had passed the regular physical examination for flyers. However, clinically it has been observed that pilots with many hundreds of hours of flying have thickened drums and other signs of middle

. McGibbon, J. E. G., and Kritzler, R.: Personal munication to the author.

ear disease sooner or later. It is with recurrent acute aero-otitis, especially if there is suppuration, that permanent conduction deafness may develop.

Perceptive Type.—There is a type of nerve deafness which occurs in a few flyers.[12] It is characterized by a sudden onset during rapid descent, and there is little if any recovery. Vertigo may be complained of at first, also severe tinnitus of the hissing, nonvibratory inner ear type. The deafness may be complete, but I have observed 2 cases in which there was an average loss for the entire range of 60 decibels with the better ear masked (fig. 7). The mechanism of production of this type of deafness is presumably intralabyrinthine hemorrhage, although other changes in the endolymphatic system could cause it—a sudden "choked labyrinth" of the type associated with Ménière's disease, for example.[13] It is hoped that some day specimens from patients who had complained of this type of deafness will be available. Incidentally, anoxia, either acute or subacute, could theoretically cause deafness in one or both ears just as it occasion produces blindness without any other sympto Much against this theory is the fact that ther no evidence that any of the patients in wh nerve deafness developed had been subjecte reduced oxygen. Suffice it to say that su hemorrhages similar to those seen with car monoxide poisoning can occur in the labyri of flyers and presumably are the cause of sud nerve type deafness. Whether the hemorrh are due to sudden changes of intralabyrinth pressure or to changes in capillary permeab or to some other cause is a matter of specula

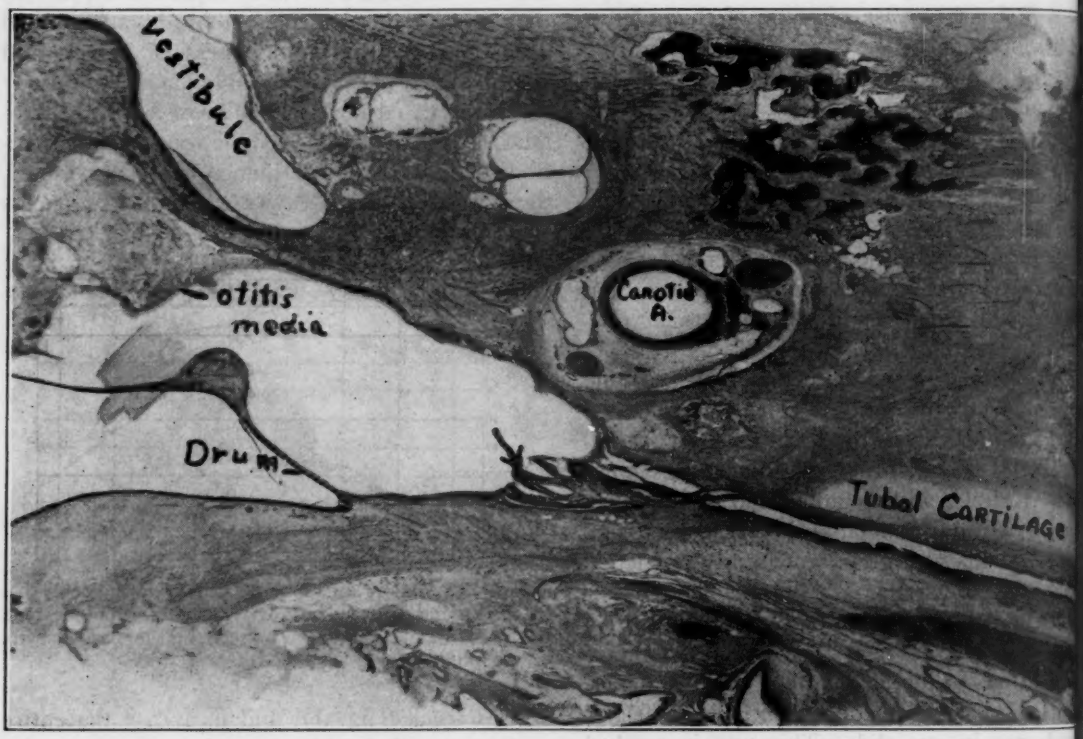


Fig. 8.—Hypertrophied mucous membrane (arrow) in the middle ear end of a eustachian tube. This c easily block the tube on ascent. Magnification, × 6. Section from the Department of Otolaryngology, Colu University, New York, United States Army Medical Museum neg. no. 82627.

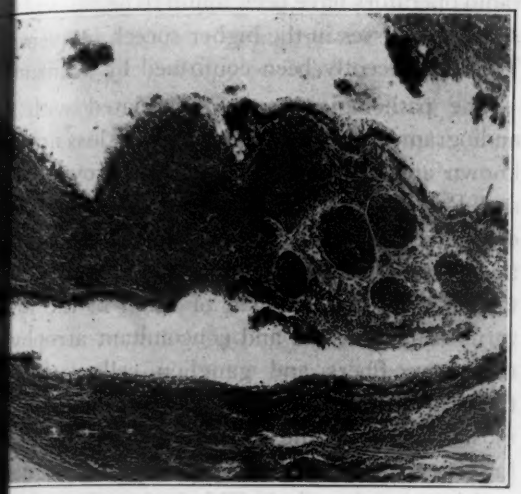
12. Simpson, J. F.: General Survey of Otorhinological Considerations in Service Aviation, J. Laryng. & Otol. **57**:1 (Jan.) 1942. Dickson and others.[1] Armstrong.[4]

13. Hallpike, C. S., and Cairns, H.: Observations on Pathology of Ménière's Syndrome, J. Laryng. & Otol. **53**:625 (Oct.) 1938.

DEAFNESS FROM ASCENT

Deafness which develops while the patien going up in an airplane is usually transient, sometimes it remains throughout the flight may persist afterward. The mechanism of production is probably similar to that of deafn from descent; in the deafness from ascent, h ever, the closing of the eustachian tube must due to a ball-valve action which prevents escaping from the middle ear. Flaps such as th shown in figure 6 or masses of lymphoid tis such as those seen in figure 3 could be respons for this phenomenon if they lie in the right p tion. Two other possible mechanisms for the p duction of deafness in ascent are the polyp

s which occasionally develop in the middle itself (fig. 8). These may become congested engorged and so more easily fill the oval



ig. 9.—Engorged polypoid mass at the middle ear of the eustachian tube of an airman who died of xia at 23,000 feet. Note swollen vessels and sub-cosal hemorrhage. Magnification, × 42. Photograph Mr. Hudson of the Department of Pathology, Cam-lge University, England.

bother him. Since his first operational mission his deafness had been so severe at high altitudes that the bombardier had to hand him notes in order to communicate with him. This was found unsatisfactory when his ship was attacked by an enemy plane in the quadrant covered by the navigator's guns. The rest of his crew complained. The squadron surgeon on the ground observed congestion of the drums but found no apparent deafness for the ordinary voice (fig. 11 *A*). When the officer was examined in a general hospital a few days later, there was no congestion, only slight retraction and thickening of the drums. There was slight hyperplasia of lymphoid tissue on the lateral walls of the nasopharynx, but the eustachian tubes could be inflated normally by the Politzer method. Several weeks later, after three radium treatments, he was tested in a decompression chamber. During simulated ascent at 2,000 feet (610 meters) per minute the drums bulged slightly every so often and then flattened out in the usual way until pressure the equivalent of that at 16,000 feet (4,875 meters) of altitude was reached. At 16,000 feet the drums began to remain bulged, and at 23,000 feet (7,000 meters) the bulge was marked. Deafness was severe, and the audiogram showed an over-all loss of 45 decibels (fig. 11 *B*). On recompression the drums returned to their normal position at the pressure equivalent of 16,000 feet, and then as simulated descent continued congestion became apparent. At normal atmospheric pressure the drums were retracted and hyperemic. Mild aero-otitis with some fluid appeared to be present, but the audiogram approached normal (fig. 11 *C*).

Fig. 10.—Arrow indicates partially organized exudate in the mouth of a eustachian tube. Plugs of this type y be found at either end of the tube or in the middle of it. Magnification, × 10. United States Army Medical useum neg. no. 82364.

y end of the tube (fig. 9). Partially organ-d exudate could also block the opening to the ddle ear (fig. 10). Some of the pilots who mplain of deafness at high altitudes have nor-l or near normal hearing when they reach the ound, and this causes them to be suspected of lingering. The following case is an example:

Lieutenant X. was a navigator with a year of ining and 400 hours of flying in a heavy bomber as ll as eight operational missions over enemy terri-y to his record. He had slight difficulty clearing tubes at times during training but not enough to

This test was repeated a second time, with nearly identical audiometric findings. After recompression the hearing loss was so slight that the patient had no difficulty with conversation, and in an ordinary testing room he seemed to have 20/20 hearing on the left and 15/20 hearing on the right when tested with a whisper. This is not unusual when the threshold audiogram shows an average loss for the speech range of this magnitude.

I have examined 3 other officers with the complaint of deafness on ascent and inability to clear their ears at high altitude, but none of them had objective abnormalities at the time they were

examined, several days after their last flight. A fourth officer, a fighter pilot, had in addition to his deafness severe pain in the right ear on rapid ascent to 10,000 feet (300 meters), which was suddenly relieved by rupture of the ear drum at 12,000 feet (3,650 meters). After his return to the ground a typical traumatic perforation was observed by his flight surgeon. This healed in a few weeks, but on his return to the air perforation recurred in ascent. When the officer was subsequently examined in a general hospital, there was a slightly thickened drum, a round ragged-edged perforation in the lower posterior quadrant of the pars tensa and deafness averaging 30 decibels of loss for the speech range. Deafness

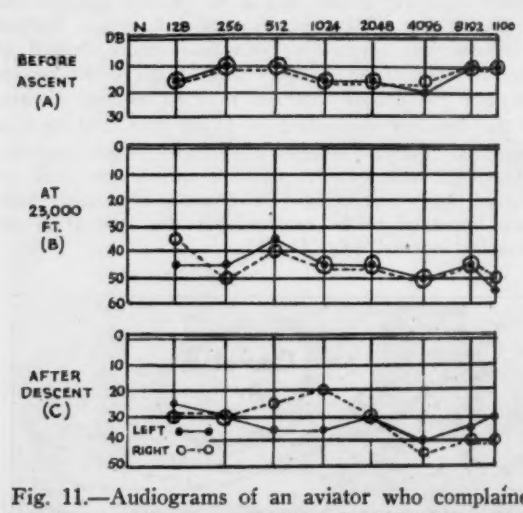


Fig. 11.—Audiograms of an aviator who complained of deafness while at an altitude of 16,000 feet. Note that hearing returned to a serviceable level (*C*) on return to normal atmospheric pressure. The audiometric tests were done in a decompression chamber at the First Central Medical Establishment of the American Air Force.

occurring on ascent in 2 other fighter pilots was said to be periodic. They said that if deafness had not occurred by the time 10,000 feet was reached it usually did not occur at all. When it did occur, however, it was severe enough to prevent reception of radio communications with the full volume attainable from the instruments of a fighter plane. They showed no objective abnormalities.

DEAFNESS DUE TO ACOUSTIC TRAUMA

Permanent loss of hearing following exposure to motor and propeller noise is occasionally found in aviators even today. It was extremely common when flying was done in planes with open cockpits. Figure 12 *A* is an audiogram typical of nerve deafness from acoustic trauma. Abr high tone loss like this in aviators was called Bunch [14] "aviation noise deafness." Gunners radio operators have been found to be particula subject to losses in the higher speech frequenc This has recently been confirmed by Ullman

The pathologic changes associated with audiogram showing abrupt high tone loss are known and are best described by Crowe, G and Polvogt in their classic paper on high t deafness.[16] Essentially they consist of destr tion or modification of the hair cells and sust tacular cells of the organ of Corti in the lo turns of the cochlea and concomitant atrophy the nerve fibers and ganglion cells supply these areas. The process is most marked most common at the end of the first half of lowest cochlear turn, i. e., just before it begins curl into a tight spiral. This is thought to be area most sensitive to the frequency 409 That the hearing of normal persons in a plan reduced by the masking effect of the noises pr ent is obvious. The noise level within a pl varies, according to Armstrong,[4] as follow 60 decibels in an ultramodern soundproof cab 80 decibels in the usual commercial sou proof cabin, 100 decibels in a closed cockpit, decibels in an open cockpit and 130 decibels w the head out in the slip stream. The hear should vary accordingly. In a military airc during operational flight a communication usu requires a fairly loud shout close to the ear to understood, i. e., 90 to 100 decibels. Well fitt ear phones reduce the outside noise level ab 20 decibels, so that one does not have to sh over the interphone if it is working properly.

Slight deafness from motor and propeller no persists in many aviators for a short time af flight, especially if the motor is in the nose the ship. Such transient deafness has been m ured by Campbell [18] and others.[4] Some pers

14. Bunch, C. C.: Traumatic Deafness, in Fow E. P., Jr.: Medicine of the Ear, New York, T Nelson & Sons, 1939.

15. Ullmann, E. V.: Traumatic Deafness in Com Flyers, Arch. Otolaryng. **40**:374 (Nov.) 1944.

16. Crowe, S. J.; Guild, S. R., and Polvogt, L. Observations on Pathology of High Tone Deafn Bull. Johns Hopkins Hosp. **54**:315 (May) 1934.

17. Davis, H.: The Physiology of Hearing, in Fo ler, E. P., Jr.: Medicine of the Ear, New York, T Nelson & Sons, 1939.

18. Campbell, P. A.: Effect of Flight on Hear J. Aviation Med. **13**:56 (March) 1942.

abnormally sensitive to noise, however, and ir deafness may last for several hours. Even ugh they are more deafened than their fellows the plane, they may have normal or nearly rmal hearing for speech and the speech tones the time they are tested in a hospital.

t is important to differentiate cases of abnor- fatigue deafness due to airplane noise from es of malingering, hysterical deafness and fness due to the barotrauma of ascent or de- nt. Tests with the audiometer such as those cribed in a following paragraph should be a p in making a differential diagnosis.

Lieutenant Y. complained that after a half hour in cockpit of a B17 he was unable to hear the inter- ne and that the deafness increased as the plane ned altitude (the longer he was exposed to the sound the motors). If the mission was a long one, he ld remain deafened for several days after descent; was short, the deafness often disappeared in twenty- r hours. This officer had done a great deal of duck oting and skeet shooting and had worked on a range re 30 caliber and 50 caliber machine gun practice engaged in. He had had slight tinnitus in each for two years following an episode of several days work on the machine gun range. Physical examina-

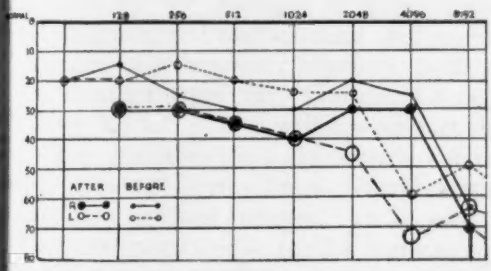


Fig. 12.—Audiogram of an aviator who complained transitory deafness after flight in a heavy bomber. hearing was recorded before and after exposure for ifteen minutes to a 65 decibel buzzer masker. Normal sons showed no change in their hearing after ex- ure to this noise level.

n of his ear, nose and throat disclosed nothing except ght deafness to residual air whisper if unrelated words e used.

The audiogram is shown in figure 12. After fifteen utes with a buzzer masker (Maico) running at roximately 65 decibels the hearing dropped 10 to 15 ibels for the lower tones and 5 to 20 decibels for higher tones. Fifteen minutes of the same sound duced in normal persons no deafness which could measured with ordinary audiometer technic.

t is possible that the early severe acoustic uma destroyed part of the neural mechanism hearing for low tones in this man in some but left enough nerve fibers working to con- t weak sounds. Enough were destroyed, however, so that with loud sounds the remaining ones became easily overburdened and fatigued. Or perhaps the individual fibers to the lower notes are affected so that although they are capable of responding to weak intensities, they are quickly fatigued when subjected to louder intensities. It has been shown by Wilson [19] that the soldiers who are most easily fatigued by a pure tone of 256 cycles per second are most apt to have high tone losses after rifle fire. It is probable, therefore, that the phenomenon described here is due to individual susceptibility to fatigue. Persons who suffer from previous acoustic trauma most often complain of deafness from noise. Their ears are easily fatigued by a low intensity hum which will not affect normal ears. That other types of nerve deafness are probably also associated with easy fatigue is evidenced by the histories of the patients and their relative intolerance for hearing aids.

REDUCED HEARING FROM OTHER FACTORS

Canfield [20] suggested two other possible reasons for reduced hearing at high altitude. First there may be a change in intelligibility due to the physiologic action of the larynx of a speaker in rarefied atmosphere. Although the oxygen content of air breathed at high altitude is sufficient to maintain good exchange, the weight of the air breathed is diminished enough to produce abnormal speech. This abnormality is due to altered relative sound frequency and intensity combinations. Second, during actual tests made at reduced pressures it was noted that fewer words could be produced during a single expiration than at ground level pressures. Thus a fatigue factor may enter, reducing the speech volume put into the interphone. Both of these possibilities require further elaboration, but because few aviators complain of deafness at high altitude, other individual factors occurring in these particular flyers probably play a more important role.

SUMMARY AND CONCLUSIONS

1. Slight transient deafness due to mechanical splinting of the ossicular chain or to edema and congestion in the submucosa of the drum and the ossicles is common in flyers.

19. Wilson, W. H.: Prevention of Traumatic Deafness: A Preliminary Report, Arch. Otolaryng. **37**:757 (June) 1943.

20. Canfield, N.: Personal communication to the author.

2. In the course of many months or years of flying more and more connective tissue tends to develop in the middle ear and may produce conduction deafness. This has been suspected clinically, and pathologic study demonstrated it in 4 of 26 temporal bones. All 4 of the airmen represented had much more flying experience than those who did not show the connective tissue.

3. The following conditions which appear to be conducive to otitis media from barotrauma (aero-otitis) are found in pathologic specimens: (*a*) infection of the submucosa of the eustachian tube; (*b*) hyperplasia of lymphoid tissue in and about the mouth of the eustachian tube; (*c*) hyperplastic polypoid growth and hypersecretion of the mucous membranes and glands of the tube; (*d*) presence of thick or organized exudate. Photomicrographs of these conditions are shown.

4. These conditions may occur at the middle ear end of the tube and produce deafness on ascent which disappears again on descent.

5. Some flyers will become temporarily mo deafened than their fellows by the noise fro airplanes. Such auditory fatigue is most comm in patients with a history of previous seve acoustic trauma or other nerve deafness.

6. An audiometric test for auditory fatigabili is helpful in diagnosis.

7. Sudden severe perception deafness, usual unilateral, may occur without known cause experienced flyers during a rapid change of al tude. Presumably there is a hemorrhage in t labyrinth. This deafness is permanent.

8. Other types of reduced hearing occur b are relatively unimportant.

9. Until a thorough knowledge of the effect flight on the ear is available the temporal bon of many aviators should be removed after dea for microscopic study.

INTRODUCTION OF AN ARTISTIC POINT OF VIEW IN REGARD TO RHINOPLASTIC DIAGNOSIS

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To those who scoff at any attempt to confine perfect symmetry within mathematical boundaries let me quote from Brenda Putnam's [1] excellent volume "The Sculptor's Way." She says, "To those who instinctively feel that the perfect proportions of the body must be founded on some rational laws of mathematics (as in music), I strongly advise the study of the artist Wilford L. Conrow and his collaborator Dr. William Churchill. Between them they have evolved a convincingly logical method of determining the ratio of perfect proportion." She goes on to say that such investigations are by no means new. Plato and Euclid delved deep into the study, and Leonardo DaVinci was profoundly convinced that only through mathematics could the laws of symmetry be found.. Pamphlets giving a basis for the findings, including photographs, diagrams and mathematical and geometric formulas, together with biometric patterns, can be obtained from Mr. Conrow, Carnegie Hall, New York. It is a well known fact that artists and sculptors find themselves subconsciously drawing figures on a general mathematical basis without reason. In a way, it represents an instinctive search for harmony and logic.

In rhinoplasty, perfect symmetry is not necessarily the aim, but a good nasal reconstruction not only should bring anatomic abnormalities within the normal range but should take into consideration the esthetic abnormalities. These esthetic variations should also be brought within the range of a more ideal esthetic concept.

The importance of the nose as a factor contributing to facial beauty is greatly overrated. The nose is only a detail in the face and should never be so conspicuous as to attract undue attention. It should blend with its surroundings in a pleasing way and assume its proper importance in the general design of the face. A beautiful nose on an otherwise unattractive face will certainly not be an asset. In fact, it will defeat its own purpose since by contrast it will make the unattractiveness of the surrounding features strikingly apparent. On the other hand, if the nose is in harmony with its neighboring structures, the resulting good facial balance will often create an illusion of beauty. If noses were transposed instead of remodeled, no one would interchange the nose of a Negro and the nose of a white man, even if the color of the skin matched. Each race has its own individual characteristics, and each possesses a distinct type of beauty, but they do not mix. One cannot scramble racial types and attain harmony. Likewise one should never completely sacrifice facial harmony for the sake of obtaining what is considered a beautiful nose. The face must be studied as an entity, and the nose should bear a good structural relationship to the balance of the face and form a pleasing part of the design.

There is little doubt that many people are nose conscious, and most of them labor under the mistaken idea that a good nose is a panacea for every facial defect. Unfortunately, this is seldom true. Often a person is determined to have his nose remodeled, being unaware of the fact that the nose is good and the chief fault lies elsewhere. For some unknown reason he overlooks the rest of the face and is prone to accuse his nose of being the offender. He believes that correcting the nose will completely change his appearance. Under these circumstances, if such a nose is remodeled, the patient will be sorely disappointed with the result.

Styles are constantly changing, and that of beauty is no exception. Although Greek statues and Italian paintings are still outstanding examples of beauty in art, they are useless as modern standards of beauty. To the general public, the modern ideal is portrayed in movie stars, magazine illustrations and highly publicized professional models. The amount of advertising is no guarantee or criterion of artistic merit, but it undoubtedly influences public opinion.

Down through the ages, artists have always searched for the unusual, and when they were unable to find it, they created it by exaggerating

Read before the Section on Otolaryngology of the College of Physicians of Philadelphia and the Philadelphia Otolaryngologic Society, Jan. 17, 1945.

1. Putnam, B.: The Sculptor's Way, New York, Farrar & Rinehart, Inc., 1939.

and distorting. Modern artists have carried this to such an extreme that unless a painting or a piece of sculpture carries a shock with it, it is likely to go unnoticed. At the present time rhinoplasty and even academic art have little in common. Art takes the high road and seeks to create the unusual, while rhinoplasty takes the low road and seeks to remove all traces of it. Rhinoplasty should compromise and strive to maintain some traces of the original feeling instead of destroying it completely.

Each face requires a nose in keeping with its age, type, race and general physical characteristics (figs. 1 to 4). When a remodeled nose is robbed of all the qualities that make it the proper nose for that particular face, an artistic crime is committed. There is an underlying pattern in every individual subject which should be classified and every effort made to follow it as closely as possible. It is well to remember

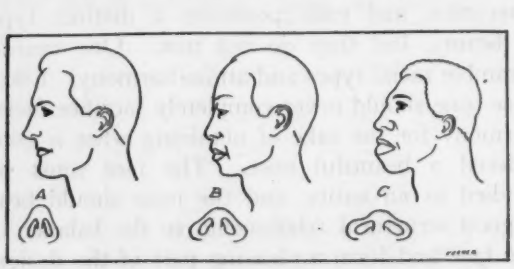


Fig. 1.—Racial types, with a basal view of the nose of each: *A*, European or American, with vertical nostrils; *B*, Asiatic, with oblique nostrils; *C*, African, with horizontal nostrils.

that minor alterations do not change the pattern; major ones do.

Most people can be classified under one of the illustrated types in spite of countless variations (figs. 3 and 4). It is seldom that we encounter a tall, lean, gaunt, bony type of person with a short, bulbous pug nose. The bony structure of the nose follows that of the head and the body, the basic pattern of the subject.

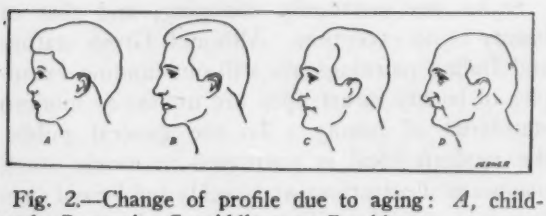


Fig. 2.—Change of profile due to aging: *A*, childhood; *B*, youth; *C*, middle age; *D*, old age.

In the short roly-poly type, the structure of the head is in keeping with that of the body, and the nose is no exception. A beautifully cleancut cameo type of nose belongs to a well proportioned, finely modeled head and would be inharmonious on a head of any other type. Visu ize such a nose on the face of a bull-necke beetle-browed, square-jawed man. It would n be an exaggeration to say that the result wo be caricature. On the other hand, picture slim, delicate, swan-necked girl with a crag

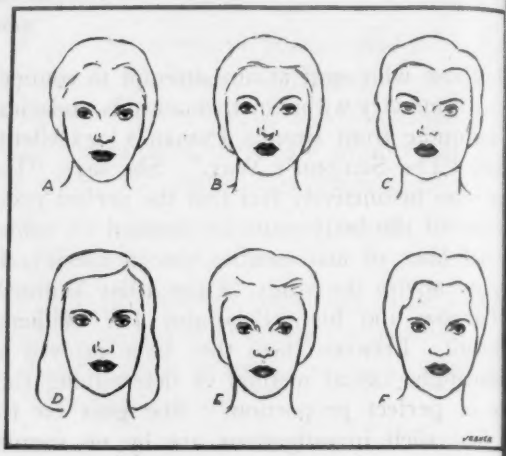


Fig. 3.—Types of faces: *A*, oval; *B*, round; square; *D*, rectangular; *E*, triangular; *F*, diam shaped.

massive eagle nose. How utterly ridiculous would look! If one could transpose these nos one would have facial harmony in both exa ples. Of course, these instances of facial d harmony are highly exaggerated, but some resu of rhinoplasty are almost as shocking to a train eye as those misplaced noses would be to t

Fig. 4.—Verner classification of facial profiles: rectilinear; *B*, anterior oblique; *C*, posterior oblique *D*, concave; *E*, convex.

average person. It does not necessarily follo that a poor rhinoplasty is always pleasing an average person. He will sense somethi "queer" about the face, but he is unable analyze it. His knowledge along these lines undeveloped, and he is conscious only of a vag feeling of dissatisfaction. On the other han when complete facial harmony is attained, he m subconsciously recognize it and be pleased wi out knowing why.

If a nose with a large hump and a hangi tip is true to type in following the basic patte of the head, it should never be altered to su an extent that it loses its character complete (fig. 5). Such a procedure would remove

dividual character and change the original pattern so that the nose would no longer be in keeping with the face. Every attempt should be made to retain the original feeling of the nose, and, in the correction, remove only the excess of hump and hanging tip that causes it to be unduly conspicuous. The nose not only will be greatly improved by being brought within normal limits but will still retain some vestige of its character and so be in harmony with the

Fig. 5.—The importance of retaining the original pattern and character in nasal reconstruction: *A*, original deformity; *B*, overcorrection—nose too short; *C*, good surgical correction but poor artistic judgment; *D*, good surgical correction with good artistic judgment. Note in *D* the slight wave in the dorsum of the nose and the retention of the graceful curve in the columella.

rest of the face (fig. 5). The upper lip is also an important factor to be considered. If the upper lip is long, a long nose cannot stand much shortening. Shortening such a nose will create the illusion of lengthening the already long upper lip, and the result will only substitute one de-

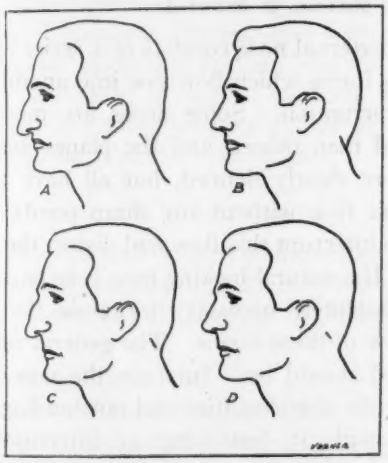


Fig. 6.—The importance of the upper lip in rhinoplasty: *A*, a long nose with a short upper lip; *B*, correction to improve facial proportions, giving the illusion of a lengthened upper lip; *C*, same nasal deformity with a long upper lip; *D*, the same correction but unsatisfactory because the deformity of the upper lip is exaggerated.

formity for another (fig. 6 *C* and *D*). On the other hand, a long nose with a short upper lip can stand more shortening, because this creates the illusion of a lengthened short lip, and thus the facial proportions are improved (fig. 6 *A* and *B*). A long nose with a normal upper lip will require good judgment on the part of the operator when he decides what amount of shortening is necessary to obtain the most pleasing effect. The foregoing illustrations are sufficient

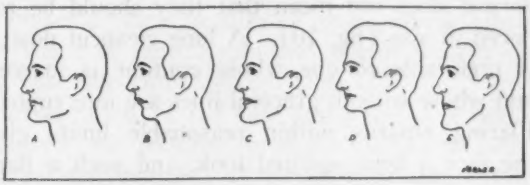


Fig. 7.—Abnormalities of the chin and the lower part of the face: *A*, ideal face; *B*, receding chin; *C*, protruding chin; *D*, short lower part of face; *E*, long lower part of face.

to explain why the same surgical procedure will not properly correct two noses identical in size and shape. Protrusion or recession of the chin, the upper lip or the forehead must be taken into consideration and, if it is properly analyzed

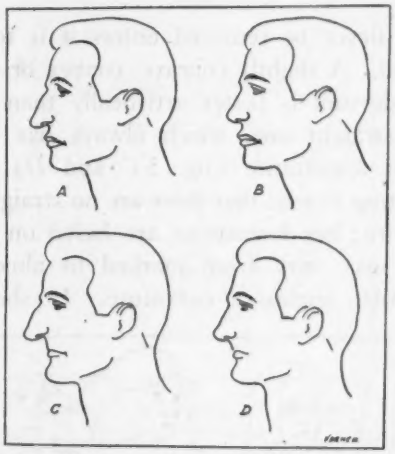


Fig. 8.—Relation of the nasolabial angle to abnormalities of the lips: *A*, nasal deformity with protruding lips; *B*, correction of nasal deformity; *C*, nasal deformity with receding lips; *D*, correction of nasal deformity.

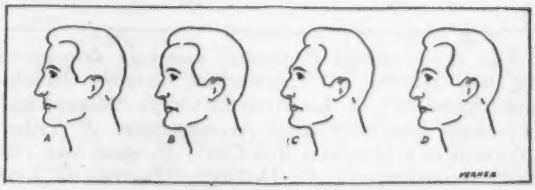


Fig. 9.—Abnormalities of the forehead: *A*, normal forehead; *B*, protruding forehead; *C*, receding forehead; *D*, absence of the frontonasal angle.

and compensated for, this may make all the difference in the world (figs. 7, 8 and 9).

One frequently encounters small close-set eyes, which may give the illusion of wide alae. In such

an instance, it is best not to narrow the alae, as this will cause the whole hub of the face to have a mean, tight look.

Nostrils vary greatly in size and in shape. The fact that a patient's nostrils are longer than normal does not mean that they should be reduced in size (fig. 10). A long cleancut nostril is preferable to one whose contour is marred and whose smooth graceful lines are interrupted. Flaring nostrils within reasonable limits give the face a keen spirited look, and such a flare

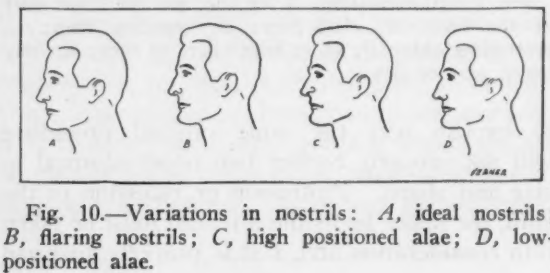


Fig. 10.—Variations in nostrils: *A*, ideal nostrils; *B*, flaring nostrils; *C*, high positioned alae; *D*, low-positioned alae.

should never be removed unless it is too pronounced. A slightly concave, convex or slightly wavy dorsum is better artistically than a perfectly straight one, which always has a stiff, wooden appearance (fig. 5 *C* and *D*). It is interesting to note that there are no straight lines in nature; her formations are based on curves, which may vary from marked to almost imperceptible angles of curvature. In short, the

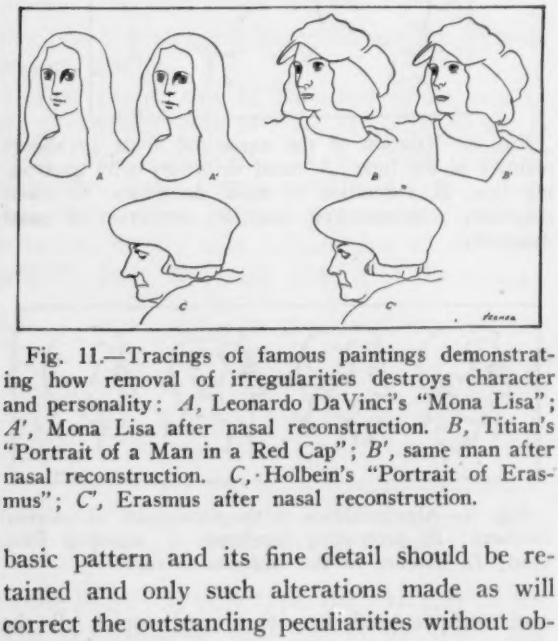


Fig. 11.—Tracings of famous paintings demonstrating how removal of irregularities destroys character and personality: *A*, Leonardo DaVinci's "Mona Lisa"; *A'*, Mona Lisa after nasal reconstruction. *B*, Titian's "Portrait of a Man in a Red Cap"; *B'*, same man after nasal reconstruction. *C*, Holbein's "Portrait of Erasmus"; *C'*, Erasmus after nasal reconstruction.

basic pattern and its fine detail should be retained and only such alterations made as will correct the outstanding peculiarities without obliterating the character, spirit and feeling of the face. Often the most attractive faces are the ones the features of which are far from perfect. Variations and irregularities lend color and cha to what otherwise might be a dull, uninteresti face (fig. 11). The variations in faces are e less, but as a general rule a broad face calls f a broad nose, a short face for a short nose a a long face for a long nose. In other wor the style and type of nose must match the str ture of the head if one seeks to attain go facial balance.

How should one judge a well executed rhi plasty? A well remodeled nose should lo as though it grew there, not as if it had be borrowed in a hurry for some special occasi A nose robbed of its original feeling looks su gical. A result should be considered adequ only when the trained observer is unable to det the reconstruction. Many nasal reconstructio can be spotted immediately, because there something about them that attracts attenti Some of the outstanding faults are as follow

1. The nose is too short for the face, and the tip too elevated.
2. The columella forms a straight, taut line inste of a gentle, sweeping curve.
3. The alae seem to be pinched and contracted.
4. The lobule is pinched, exaggerating the gro between the alae and the lobule.
5. The nasolabial angle is too wide or is webbed.
6. The columella is retracted.
7. The anterior angles of the nostrils are too point
8. The philtrum is distorted.

The external nose consists of a series of gen curving forms which flow one into another wi out interruption. Some noses are more fin modeled than others, and the planes and fac are more clearly defined, but all have a gen rhythmic flow without any sharp points or ar facts to interrupt this flow and distort the natu form. If a natural-looking nose is to be obtain it is absolutely necessary to retain the rhyt and flow of these forms. The general rule to followed should be: Improve the nose by c recting the abnormalities and outstanding pecu arities without destroying or interrupting t curves and the forms of the natural design.

The methods of analysis used in rhinopla are well known. They serve to ascertain ac rately a true picture of the anatomic abnorma ties. The addition of an artistic evaluation the conventional diagnostic methods will g the operating surgeon a powerful weapon w which to improve his postoperative results. Wh criteria should the surgeon adopt to assure p

2. Daley, J.: Retaining a Correct Septolabial An in Rhinoplasty, Arch. Otolaryng. **39**:348 (April) 19

able results in nasal reconstruction? They be enumerated as follows:

He must visualize the end result.

He must be conversant wtih the esthetic as well as anatomic abnormalities.

He must provide for facial balance and harmony plan to remodel the nose to fit the particular type.

He must strive to retain as much of the original gn of the nose as possible.

He must preserve the curves and the form of the ral design of the nose.

t is not possible to give any set formula beauty. No one has ever successfully defined uty, much less cut a pattern for it; but ways e been devised for those lacking artistic ity to enable them to analyze a face and rmine whether or not its peculiarities fall side the "norm." These methods were orig- lly devised by artists and sculptors for their use. Since then they have been developed adapted for facial analysis the purpose of ch is to determine in a general way the tomic abnormalities and the measures neces- y to bring them within the normal pattern. se methods should be carefully studied, and ugh they are not perfect and will never replace stic judgment, nevertheless they offer the procedure which has been discovered up to present time. The rhinoplastic surgeon ld be wise to train a competent artist to guide in his preoperative planning, as well as in rating. Of course, rhinoplasties will not al- ys turn out "according to plan," but the appli- on of the basic principles outlined in this sentation indicates the proper goal at which rhinoplastic surgeon should aim.

FACIAL ANALYSIS

Facial analysis may be divided into three parts: the artistic evaluation, (2) the rhinoplastic mination and (3) the analysis of photographs casts.

The Artistic Evaluation.—The artistic evalua- has already been discussed, and I cannot remphasize the importance of this survey. s phase of the examination should be of major rest to the surgeon, for on it may depend success or the failure of the operation as as the indications for surgical intervention. his examination does not show the nose to at fault or does not permit one to predict d facial balance, the operation certainly should be performed. I am convinced that no gical procedure should be attempted without examination.

The Rhinoplastic Examination.—The rhino- stic examination consists mainly of a visual examination of the nose and the component parts.[3] The examination of the profile and that of the full face consist of evaluating the anatomic components of the nose (the bony vault and the upper and lower lateral cartilaginous vaults) and their relation to the abnormalities. I like Topinard's [4] classification of noses, which takes the shape of the dorsum and the inclination of the base into consideration (fig. 12).

Observation of the full face gives a general picture of the relationship of the nose to the surrounding structures. It demonstrates the width of the nose as related to the with of the face, to the width between the inner canthi and to the width of the mouth.

The basal examination of the nose demonstrates the shape, the size and the symmetry of the nostrils.

Visual examination gives only a general idea of the pattern; it is the analysis of photographs

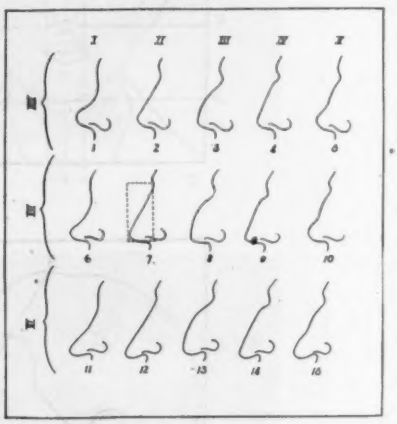


Fig. 12.—Topinard's classification of noses: *I*, concave dorsum; *II*, rectilinear dorsum; *III*, convex dorsum; *IV*, humped nose; *V*, undulated dorsum; *VI*, depressed base; *VII*, horizontal base; *VIII*, elevated base.

and casts which gives the precise and detailed information that is of greatest practical value to the surgeon.

The Analysis of Photographs and Casts.—Charting of Photographs: Photographs for analysis should be made by a medical photographer and should consist of four views: (*a*) full face (one-half life size), (*b*) left profile (one-half life size), (*c*) right profile (one-half life size) and (*d*) basal view (life size). Some surgeons also add a three-quarter view, but this is not absolutely necessary.

3. Fomon, S.: Surgery of Injury and Plastic Repair, Baltimore, William Wood & Company, 1939.

4. Topinard, P.: Anthropology, London, Chapman and Hall, 1890.

The photographs are covered with cellophane, and the necessary lines and data are charted with a map-marking pencil.[6] A transparent ruler and a protractor are all the equipment that is necessary. This procedure is used to demonstrate asymmetry as well as deformities of the nose. These photographs are also useful as a record when one wishes to compare the postoperative reconstruction with the original deformity. Charting of the full face, profile and basal views gives preoperative information of great value to the surgeon, and no rhinoplasty

(*a*) Charting of the Full Face: The cha of the photograph of the full face will give horizontal and vertical proportions of the as well as the symmetry of both sides of the and the face. It also demonstrates the le of the nasal tip, as well as the width of the

Five horizontal lines and three vertical are drawn (fig. 13 *I*). The horizontal lines

1. *A-A'* is drawn at the hair line.
2. *B-B'* is drawn at the level of the eyebrow.
3. *C-C'* is drawn at the alar-labial junction.
4. *D-D'* is drawn at the lower border of the ch
5. *E-E'* is drawn through the canthi of both ey

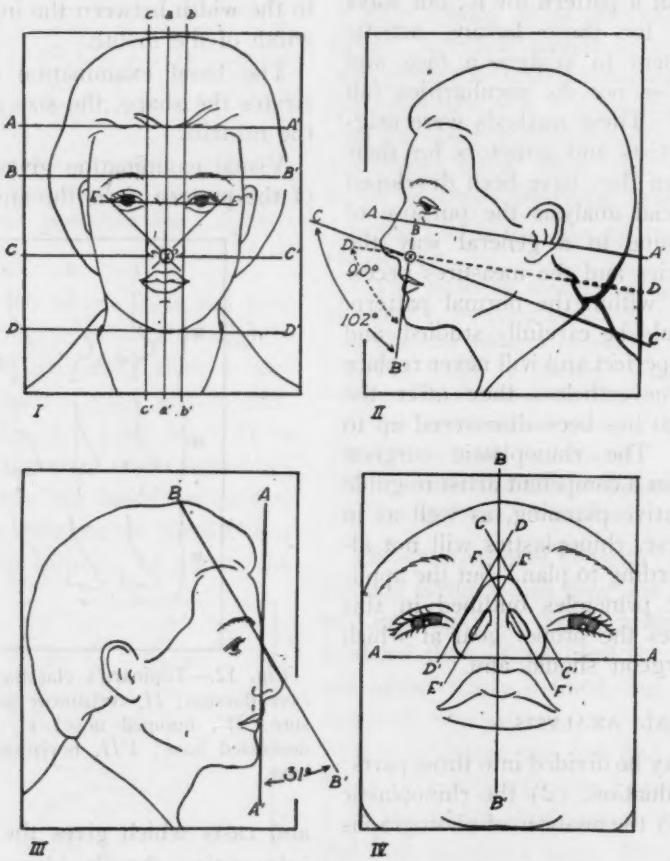


Fig. 13.—Charting an ideal face: *I*, charting of full face (see text); *II*, charting of left profile (see t *III*, charting of right profile (see text); *IV*, charting of basal view (see text).

should ever be attempted without this phase of analysis.

To make it clear I shall chart an ideal face and see what the normal relationship between the elements of the nose should be, as well as the relationship of the nose to the surrounding facial structures (fig. 13). Dr. Samuel Fomen [5] has advocated the method which I am about to describe. It is the simplest and most practical and is a distinct advance in photographic analysis.

The vertical lines are:

1. *a-a'* is drawn through the center of the li midway between the inner canthi.
2. *b-b'* is drawn through the left inner canthus p lel to *a-a'*.
3. *c-c'* is drawn through the right inner canthus allel to *a-a'*.

You will note that the alae are tangent lines *b-b'* and *c-c'* in the normal face. If the fall outside these lines the alae are too wid they fall inside these lines they are too nar Note also that the tip of the nose falls sli

5. Fomon, S.: Personal communication to the author.

the line *C-C'*. If the tip of the nose lies the line, the nose is too short, but if it below this line, the nose is too long. The ontal lines divide the face into three spaces. normal face, these three spaces should be oximately equal, especially the two lower onents. The upper space may vary, since epends on the natural hair line, which is iable.

whether or not the eyes are set closely together or wide apart. If this angle is greater than 90 degrees, the eyes are either large or wide apart; on the other hand, if this angle is less than 90 degrees, the eyes may be small or set closely together.

(*b*) Charting of the Left Profile View: The charting of the photograph of the left profile demonstrates the length of the nose and the

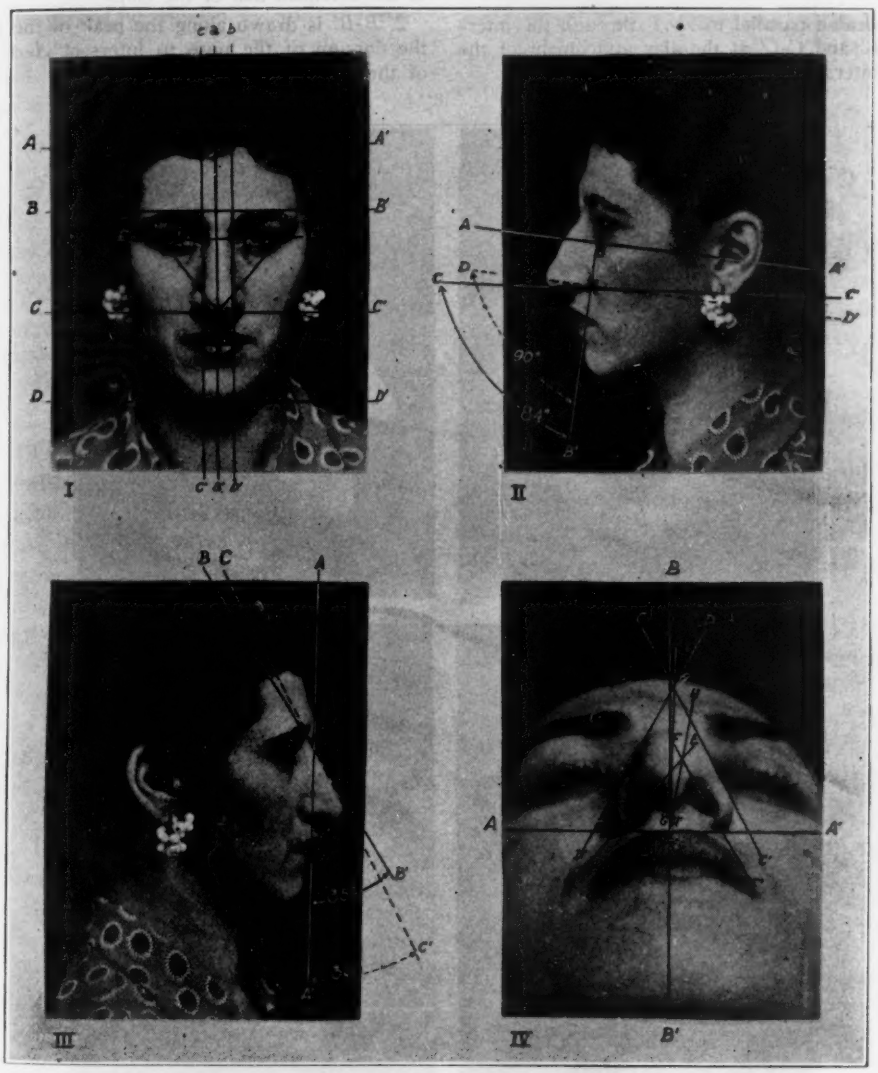


Fig. 14.—Photographic analysis in the planning of a "typical rhinoplasty": *I*, analysis of full face. Note closely set eyes. The nose is too long, the alae are too wide and the nasal tip is too bulbous. *II*, analysis profile. Note the small septolabial angle of 84 degrees and the amount of shortening necessary to bring septolabial angle to at least 90 degrees. *III*, analysis of right profile. Note the profile angle of 35 degrees the amount of hump to be removed to bring the profile angle to 30 degrees. Note the receding chin and analytic correction made by drawing line *A-A'* at the approximate position of a normal chin. *IV*, analysis basal view. Note the asymmetry of the nasal walls and the abnormal convergence of the nostrils. Note the mal width of the alae and of the nasal tip.

have added two additional lines *E-x* and *x-E'* m from the intersection of lines *C-C'* and to the outer canthi. These lines form a egree angle in the ideal face and demonstrate amount of shortening necessary. It also indicates the septolabial angle and the presence of a hanging septum or a retracted columella, as well as the direction and the length of the nos-

trils and the position and the attachment of the alae.

Three horizontal lines and one vertical line are drawn (fig. 13 *II*).

1. *A-A'* is drawn through the lower rim of the orbit and the antitragus (Frankfort horizontal).

2. *B-B'* is drawn at right angles to the Frankfort horizontal and tangent to the alar attachment to the cheek.

3. *C-C'* is drawn through the long axis of the nostrils.

4. *D-D'* is drawn parallel to *A-A'* through the intersection of *B-B'* and *C-C'* at the alar attachment of the cheek. The intersection is marked *X*.

receding upper lip or maxilla should be t into consideration and compensated for one is evaluating the nasolabial angle (fig

(*c*) Charting of the Right Profile View: charting of the photograph of the right p demonstrates the frontonasal angle and the file projection of the nose.

Two lines are drawn (fig. 13 *III*):

1. *A-A'* is drawn through the most projecting of the forehead and of the chin.

2. *B-B'* is drawn along the peak of the projecti the dorsum of the nose to intersect *A-A'* at the of the nose.

Fig. 15.—Photographs made after a "typical rhinoplasty." Note that the abnormalities have been u corrected so as to retain the original character of the nose.

Measure the angle *C-x-B'*, which should normally be between 90 degrees in men and 105 degrees in women. If the angle is greater than 90 degrees, the nose is short. If the angle is less than 90 degrees, the nose is too long. Line *C-C'* also demonstrates the presence of a hanging septum or a retracted columella, as well as low-positioned alae. A protruding or

The nasal root should fall in line with *A* If the nasal root is either dorsal or ventra this line, it indicates a projecting or a rece nasal root. The projection angle in an i face should be 30 to 35 degrees. If this a is greater, draw a line *C-C'* along the dor of the nose to form the ideal angle with *A* (fig. 14 *III*). The difference between the a

and the ideal angle indicates the amount e necessary reduction of the hump. A cting or a receding forehead or chin may isleading. Under these circumstances it is sary to compensate for any abnormalities e forehead or chin (figs. 7 to 9 and 14 *III*).

) Charting of the Basal View: The chart- f the photograph of the basal view demon- s the symmetry of the sides of the nose f the nostrils and also indicates the width e columella. The thickness and the con- of the walls of the nose as well as the dth of the base are also demonstrated.

ve lines are drawn (fig. 13 *IV*):

A-A' is drawn horizontally where the alae join p.

C-C' and *D-D'* are drawn along the walls of the

B-B' is drawn bisecting the base of the triangle d and should normally pass through the apical ection of *C-C'* and *D-D'*.

G-G' is drawn perpendicular to *A-A'* and in an nose coincides with *B-B'* (fig. 14 *IV*).

line *G-G'* does not coincide with *B-B'*, it ates a deviation of the lower cartilaginous (fig. 14 *IV*). The degree of deviation e determined by the angle formed by the *B-B'* and *G-G'* bisecting *A-A'* (fig. 14 *IV*).

ave added lines *E-E'* and *F-F'* to the basal to determine the direction of the nostrils. n ideal nose these lines are parallel to *C-C'* *D-D'* and indicate the proper convergence e nostrils. The nostrils normally should be ptic and taper toward the tip of the nose. In nalysis of the base, note if the nostrils are na-shaped, round or slitlike. Note their metry and convergence as well. *H-H'* indi- the deviation in the convergence of the trils (fig. 14 *IV*).

e width of the columella should not exceed idth of each nostril. Note the flare of the mesial crura, which sometimes project into the nostrils and obstruct breathing. The nasal walls should be observed to see if they are too thick or too thin. The lobule should be roughly triangular with a graceful, round apex. The width of the nose at the apexes of the nostrils should be approximately three fourths of the width of the base of the nose at the alar-facial junction.

Analysis of Casts: A mold of the face is made of plaster of paris, and several wax molds are made from it. These wax casts are excellent aids to the surgeon and are indispensable in preoperative planning. They are particularly valuable in the alteration of a saddle nose. The defect to be corrected can be built up on this wax cast of a sterilizable material. This model can be on hand in the operating room and in size and shape is an exact pattern of the transplant to be used. In any event, casts are a valuable addition to the equipment for facial analysis and in many ways are even better than photographs.[3] The three dimensional character of the casts is of great advantage in visualizing the end result.

I am including in this presentation the before and after photographs of a patient to illustrate the photoanalysis of a nose requiring a "typical rhinoplasty" (figs. 14 and 15). It will be noted that all four views demonstrate the more common deformities of the nose. Particular note should be taken of the after photographs demonstrating the undercorrection, which makes the nose conform with the rest of the face, keeping it in harmony with the general design of the head and the character of the patient.

The drawings used in illustration of this article were made by Jeanne Verner, who also gave assistance in the preparation of the article.

104 East Fortieth Street.

SLIGHT OPERATIVE INJURIES OF THE STAPES

HISTOPATHOLOGIC STUDY OF A CASE

FRANZ ALTMANN, M.D., AND JULES G. WALTNER, M.D.

NEW YORK

The most frequent operative injuries of the labyrinth are luxation or extraction of the stapes and opening of the lateral semicircular canal. They occur much more often during tympanomastoidectomies than during simple mastoidectomies.

The clinical literature on these operative injuries is extensive (Zange [1]; Ruttin [2]). Contributors have more or less generally agreed that luxation of the stapes is a dangerous accident. In many cases it is followed by purulent infection of the labyrinth with subsequent complete loss of hearing, and before the recent achievements of chemotherapy it frequently terminated in fatal meningitis. In some instances, however, the stapes is only slightly injured; the response to the fistula test becomes positive (Bárány [3]), but severe clinical signs and symptoms are absent. The prognosis in these cases is favorable, and there is no marked permanent loss of hearing.

Opening of the lateral semicircular canal is much less dangerous than luxation of the stapes. The fistula often closes within a relatively short time, sometimes within a few weeks. The function of the ear, however, remains, as a rule, greatly impaired or even completely lost.

The knowledge of the histologic changes in less severe injuries, not accompanied by deadly meningitis, is limited. This is easily understandable because the opportunities of getting histologic specimens showing these conditions are rare. As a rule, one has to wait for such [illegible] haps to be observed incidentally during ro[utine] examination of temporal bones.

In this paper a case of slight operative inj[ury] involving the stapes will be reported.

REPORT OF CASE [4]

O. D., a woman aged 43, was admitted to the [Presbyterian Hospital] on April 25, 1934. For ten da[ys] had suffered from bilateral acute otitis media [with] profuse discharge. Three days after admission [a] mastoidectomy was performed bilaterally becau[se] chills and a rise in temperature to 105.2 F. The m[astoid] processes were extremely well pneumatized. Both [mas]toid sinuses were exposed and their walls found n[ecrotic]. Culture of material from the left mastoid process s[howed] hemolytic streptococci. After the operation, the [tem]perature remained high, and on May 3, rose aga[in to] 105 F. On that day the left jugular vein was tie[d] a thrombus found in the left lateral sinus. The [temperature] after the operation the temperature rose again to [103] The spinal fluid contained many cells, the majori[ty] them being polymorphonuclear leukocytes; the c[ulture] showed hemolytic streptococci.

Petrositis of the left side was suspected as bein[g the] focus of the meningitis, and an attempt was ma[de] explore the petrosal tip. The dura was lifted fro[m the] anterior part of the petrosa, but the bone appe[ared] everywhere hard and healthy; then tympanomast[oidec]tomy was done. No fistula was seen leading int[o the] petrosal tip.

Postoperatively there was no change in the pa[tient's] condition. No labyrinthine signs were noticed. [The] patient died five days after the last operation.

Autopsy showed acute cerebrospinal leptomeni[tis] caused by hemolytic streptococci. A circumscribed [area] of pachymeningitis interna was seen in the regi[on of] the medial wall of the sigmoid sinus.

Histologic Examination of the Left Temporal (horizontal serial sections). — (*a*) Middle Ear: [The] drum membrane, the malleus and the incus were [absent] owing to the preceding radical mastoidectomy. [The] mucosa was still preserved on the medial wall a[nd in] recesses of the floor. It showed signs of marked h[yper]plasia with formation of many cystic cavities and [infil]erate acute inflammatory infiltration of its superf[icial] layers. The ostium of the eustachian tube contain[ed a] plug consisting mainly of red blood cells, leuk[ocytes] and fibrin. Both window niches were filled with h[yper]plastic and cystic mucosa without evidence of [fistula]

The authors were assisted by grants from the Research Council of the American Otological Society and the Hayden-Coakley Fund.

From the Department of Otolaryngology of the Columbia University College of Physicians and Surgeons and the Presbyterian Hospital.

1. Zange, J.: Die pathologische Anatomie und Physiologie der mittelohrentspringenden Labyrinthentzündungen, Wiesbaden, J. F. Bergmann, 1919; Die konservative und chirurgische Behandlung der entzündlichen Erkrankungen des Innenohres mit besonderer Berücksichtigung der Indikationsstellung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:1, 1927.

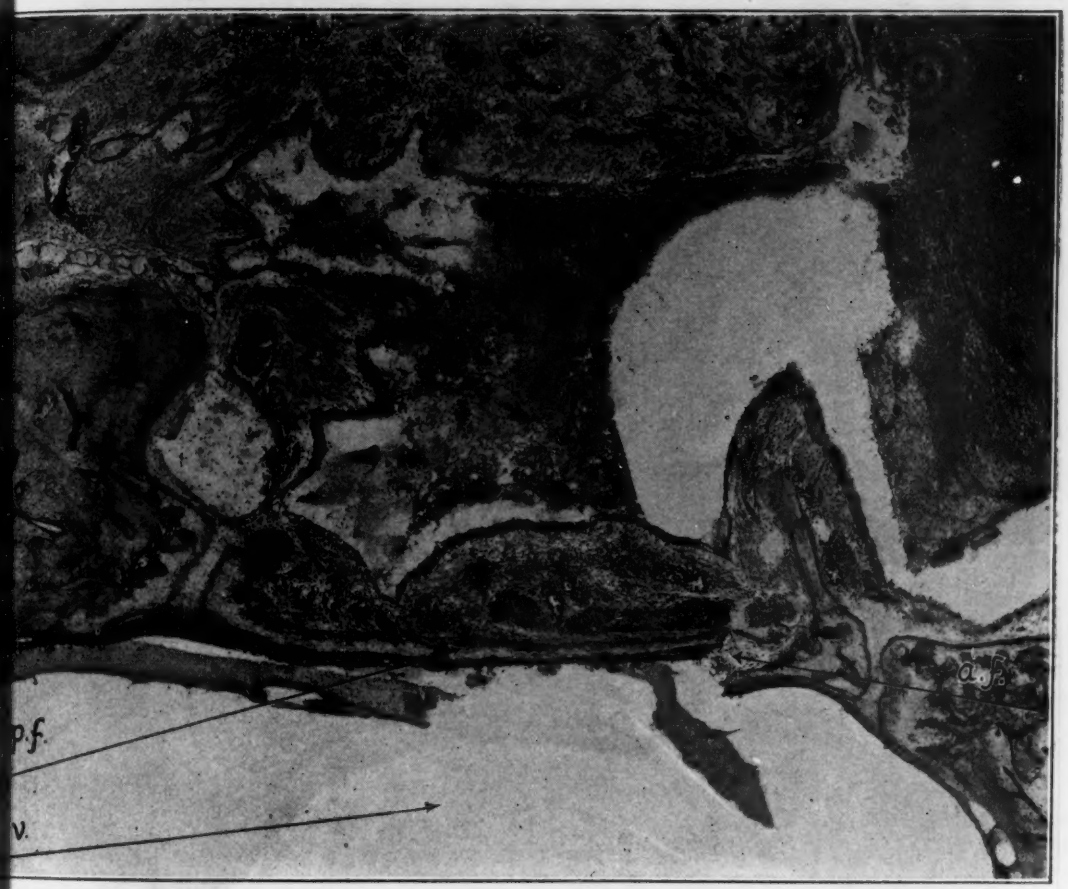
2. Ruttin, E.: Die konservative und chirurgische Behandlung der Labyrinthentzündungen mit besonderer Berücksichtigung der Indikationsstellung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **18**:104, 1927.

3. Bárány, R.: Indikationen zur Labyrinthoperation, Acta oto-laryng. **6**:260, 1924.

4. Certain features of this case have been disc[ussed] by E. P. Fowler Jr. and P. C. Swenson (Petro[sitis]: A Roentgenologic and Pathologic Correlation, A[m.] Roentgenol. **41**:317, 1939).

matory changes. The mucosa covering the membrane of the round window contained thin-walled, ged vessels. Several of them could be followed d through the entire thickness of the membrane peripheral parts of the latter near its point of ment to the medial aspect of the promontory. tapes was embedded in hyperplastic mucosa. The ar ligament looked normal. The footplate showed racture lines, both running in a vertical direction 1). The anterior line was 0.6 mm. behind the or pole of the footplate; the posterior line, 1 mm. nt of the posterior pole. The posterior fracture epresented by a narrow fissure which extended h the osseous and cartilaginous part of the footdislocated forward and inward, and a tiny splinter of bone was seen lying in the fracture line. The stapedial muscle, including its tendon, was intact.

(*b*) Mastoid Process: This contained a big operative cavity. The well developed perilabyrinthine cells were incompletely removed. Anteriorly they went over into the extremely well developed cells of the petrosal tip. Some of the cells were lined by thin regular mucosa; others, by markedly hyperplastic mucosa. Still others were filled with pus, and the mucosa was thick and infiltrated by polymorphonuclear leukocytes. In many places in this area osteoclastic erosion of the intercellular septums was visible on the surface of the trabeculae as well as in the perivascular spaces within



g. 1.—Footplate of the stapes with two fracture lines: *a. f.* indicates the anterior fracture; *p. f.*, the posterior re; *v*, the vestibule.

The endosteum remained intact with the exception ew fibers which were torn. There was extravasa- some blood between the layers of the endosteum covered the posterior fragment. The fragments ot dislocated. The fracture gap was filled with connective tissue of immature character which rown in from the mucosal covering of the foot- The anterior fracture line went through bone, ge and endosteum, which was completely torn 2). The anterior fragment was slightly dislocated rly and inward toward the vestibule. The gap n the fragments was filled with immature con- tissue originating from the deep layers of the l covering of the footplate. It was free from matory infiltration. Another fracture line went h the posterior crus of the stapes, just below the um (fig. 3). The upper fragment was slightly the trabeculae. New formation of bone was observed in only a few places. The exposed and opened lateral sinus was covered with granulation tissue; the medial wall of the sinus was thickened and infiltrated by polymorphonuclear leukocytes. The acute inflammatory changes were more marked in the petrosal tip than in the mastoid process. More than half of the tip was occupied by a large abscess cavity, which was formed by confluence of pneumatic cells. Some of the cells of the tip were free from inflammation and lined by a thin delicate mucosa. The inferior petrosal sinus showed fresh thrombophlebitis.

(*c*) Inner Ear: There was some blood in the scala tympani and the scala vestibuli, particularly at the basal turn of the cochlea. It was also found in the perilymphatic cisterna of the vestibule and the perilymphatic

spaces of the semicircular canals. In addition, there was evidence of mild diffuse serous labyrinthitis. The endolymphatic duct and sac looked normal. The cochlear aqueduct contained polymorphonuclear leukocytes in its outer, wide portion. Its inner, narrow part was filled by reticular tissue and was free from inflammatory infiltration.

(*d*) Internal Auditory Meatus: The fundus contained a small amount of pus. There was a slight infiltration of the nerve channels of the modiolus, the vestibule and Rosenthal's canal in the basal turn of the cochlea.

Histologic Examination of the Right Temporal Bone (horizontal serial sections).—There were acute inflam-

chills on the fourteenth day of acute otitis media. ing temperatures persisted, and five days later th jugular vein was ligated and a thrombus removed the sigmoid sinus. The following day purulent m gitis became manifest. Tympanomastoidectomy done and the left petrous tip explored, but no a was found. The patient died five days after th operation.

Histologic examination of the left temporal showed that an acute purulent infection of the m process had spread by the way of the perilabyri cells into the tip. The infection of the meninge occurred through the medial wall of the sigmoid A traumatic fracture of the footplate and of the po

Fig. 2.—The anterior fracture seen under higher power.

matory changes in the middle ear. The pneumatization of the mastoid process and of the petrosa was well developed. There were the same acute inflammatory changes in the pneumatic cells as on the other side, with extensive breakdown of the intercellular septums and formation of a large abscess in the petrosal tip.

There was a slight meningogenic infiltration of the nerve and vascular channels in the fundus of the internal auditory meatus.

The inner ear was practically free from pathologic changes.

Summary.— Simple mastoidectomy was performed bilaterally on a 43 year old patient because of repeated

crus of the stapes had caused moderate bleeding the perilabyrinthine space and mild serous labyrin The right temporal bone showed an acute infection remaining cells of the mastoid process with spread petrosal tip.

COMMENT

The multiple fractures of the stapes unquestionably traumatic. Most probably occurred either through energetic curetti granulations in the middle ear around the window niche or through packing the

oo tightly with gauze. Evidently the trauma not been severe, because there was hardly dislocation of the fragments. The annular ent was intact, and the endosteum on the bular surface of the footplate showed only small tear. The healing of the fractures already started, but most probably an os- union of the fragments would not have place. At least in all the reported cases The reparative changes in these cases had not progressed much farther than those observed in our case five days after the injury.

The dangers arising from energetic curetting and tight packing of the tympanic cavity are clearly demonstrated in this case. We fully agree with all those authors who leave granulations in the middle ear alone as far as possible

g. 3.—Fractured posterior crus of the stapes: *c* indicates the capitulum; *l. f.*, the lower fragment; *s*, a er in the fracture gap; *u. f.*, the upper fragment.

pt 1 (Wolff) the fragments failed to show union even after many months or years.[5]

Klestadt, W.: Spätmeningitis nach Labyrinthur, Verhandl. d. deutsch. otol. Gesellsch. **22**:229, Hoffmann, R.: Traumatische Ertaubung durch te Verletzung des Labyrinthes, Ztschr. f. Ohrenh. , 1917. Ulrich, K.: Verletzungen des Gehörorgans Schädelbasisfrakturen, Helsingfors, Mercator, 1926. Brunner, H.: Ueber den histologischen Befund an den Fenstern bei erworbener Taubheit, nebst Bemerkungen ueber die Ausheilung der operativen Stapesverletzung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **28**:79, 1931. Hallpike, C. S.: On a Case of Deaf-Mutism of Traumatic Origin, J. Laryng. & Otol. **54**:661, 1937. Wolff, D.: Microscopic Examination of Human Labyrinths from Patients Exposed to Loud Noises, Arch. Otolaryng. **36**: 843 (Dec.) 1942.

and do not attempt to close the eustachian tube by curetting forcefully the area around the ostium.

Because of the serous character of the labyrinthine infection, the patient most probably would have regained at least a large portion of her preoperative hearing. Because a complete union of the fragments of the footplate was very unlikely to take place, there was a permanent danger that purulent infection of the labyrinth might be present for years, particularly through rough manipulation of the operative cavity during after-treatment. The vascular connections between the mucosal and the endosteal covering of the round window membrane were apparently identical with those des by Dean and Wolff.[6]

SUMMARY AND CONCLUSIONS

Multiple fractures of the stapes occurr the course of a tympanomastoidectomy five before the patient's death. The injuries followed by moderate bleeding into the lymphatic spaces and mild serous labyrin This case demonstrates the dangers arising careless curetting in the neighborhood o oval window and too tight packing of the tive cavity.

6. Dean, L. W., and Wolff, D.: Pathology Routes of Infection in Labyrinthitis Secondary t dle Ear Otitis, Ann. Otol., Rhin. & Laryng. 43:702

Case Reports

MENINGITIS AND ABSCESS OF THE BRAIN DUE TO PANSINUSITIS

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ections of the paranasal sinuses which are licated by intracranial extension have always considered serious and dangerous and ly have had a rather high mortality rate. ntly, the advent of chemotherapy, and ially that of penicillin, has modified the out- in these cases. When these drugs are em- d in the treatment of infections of the para- sinuses, one should remember that occa- lly the effect on the clinical course and the e of the disease may be confusing because, the signs and the symptoms improve, fun- ntally the pathologic process is getting e. The case to be presented is especially in- ting and instructive because it illustrates the oing observations and because it presents unusual features. Although the case ter- ted fatally, it was tremendous both as to the t of work done in combating the infection s to the many interesting complications.

iefly, there is presented a critically ill young with severe diabetes, in whom sinusitis, ngitis, osteomyelitis of the frontal bone, thopneumonia and multiple abscesses of the developed. With surgical intervention and se of penicillin he improved so much that he out of bed and almost ready to go home. He suddenly became worse and succumbed to scess of the brain. The postmortem observa- were especially instructive with regard to ossible mode of entry and the extension of nfection in the brain; they illustrate also the ulties of localizing such lesions clinically. ographs of sections of the brain show the ion of the lesions.

REPORT OF A CASE

S., a man aged 33, whose occupation was that of a salesman, was admitted to the Brooklyn Eye and Hospital Dec. 30, 1943, acutely ill.

was known to be diabetic (youthful type) and aking about 70 units of insulin daily. He com- d of headache, chiefly in the left frontal region. d had a chronic sinus infection with involvement antrum and a fistula draining into the left upper lar region. The headache developed about ten before admission. It became worse, and the day before admission he noticed some swelling over the left side of the forehead.

Examination showed some edema of the skin over his forehead with tenderness on the left side. The edema involved the regions of both eyes, but there was no fixation of the eyes. The nose showed a profuse purulent discharge in the region of the left middle meatus. Clinically he was thought to be suffering from (1) acute pansinusitis of the left side and (2) diabetes mellitus.

His temperature on admission was 101.4 F.; the pulse rate, 84. The urine contained sugar (5.9 per cent) and acetone (2 plus). The blood count was 3,350,000 red cells and 14,350 white cells, with polymorphonuclears 86 per cent. The hemoglobin content was 85 per cent.

Roentgen examination of the sinuses on admission showed 2 plus involvement of the frontal, the ethmoid and the maxillary sinuses on the left side. Also noted was a periapical infection of the left lower molar tooth. No osteomyelitis was demonstrated.

The patient was placed at absolute rest in bed and maintained on a diabetic diet (1,800 calories), with insulin as ordered. Sulfadiazine was given, 30 grains (1.94 Gm.) every three hours for three doses, then 15 grains (0.97 Gm.) every four hours. Nose drops of sodium sulfathiazole and desoxyephedrine hydrochloride were used. A boric acid wet dressing was applied to the forehead. Steam inhalations were provided. A nasal tampon with epinephrine and suction twice daily were used. Morphine was given for pain. Ultrashort wave therapy was administered.

The next day, December 31, the general condition of the patient was slightly improved. The edema about the eyes was less, but some swelling in the region of the left parotid gland was present. The left antrum was irrigated and pus (3 plus) obtained. There was definite drainage from the left frontal region, although some obstruction was present because of the high deviation of the septum.

A medical consultation for the diabetic condition was requested and granted on this day. The opinion was that he had diabetes mellitus (uncontrolled). A diet and insulin were ordered.

January 2, 1944 a diabetic condition was noted. The sugar and acetone levels were fluctuating. The temperature was rising, and the headache was worse. The Proetz displacement treatment was given, a 0.5 per cent concentration of an ephedrine salt in saline solution being used, and a moderate purulent return was obtained. The headache seemed somewhat relieved.

The next day, January 3, the Killian operation was performed on the left side. An incision was made, starting over the left eyebrow and extending down toward the inner canthus, down to the periosteum, and the soft tissue retracted. The incision was then carried through the periosteum, and the contents of the orbit were retracted laterally and downward, exposing the floor of the frontal sinus. Another incision was made in the periosteum above the supraorbital ridge, and as the periosteum and soft tissues were retracted along the perpendicular plate of the frontal bone there was a sudden gush of pus, which came from the upper outer

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. Cacioppo is a specialist certified by the American of Otolaryngology.

esented at the clinical conference of the staff of rooklyn Eye and Ear Hospital on April 13, 1944.

nsultations and valuable assistance were given rs. William Herbert and Robert L. Moorhead, staff of the Brooklyn Eye and Ear Hospital.

aspect of the frontal region. The anterior wall of the left frontal sinus was removed. The sinus contained free pus and broken down cells, which were cleaned out. Material was taken for culture. The inner plate of the frontal sinus appeared intact. The floor of the frontal sinus was broken through and diseased cells of the ethmoid bone were removed. A rubber tube was placed in the nose, draining the left frontal sinus. Sulfanilamide powder was dusted into the sinus and the wound closed.

Culture of material from the sinus wound January 6 produced no growth. A smear showed occasional short chain streptococci.

In comment on the operation it should be said that instead of the usual Ferris-Smith operation, which drains the frontal sinus through the floor only, the more radical Killian operation was done on account of the severity of the symptoms and also because it would allow one to trace the origin of the pus, which seemed to come from beneath the periosteum, and also to enable one to investigate the region above the frontal sinus, where osteomyelitis of the frontal bone usually starts.

The postoperative condition on January 4 was fair. There was no headache. The urine contained sugar, 6 per cent, and gave a 4 plus reaction for acetone.

January 5 the patient's condition was worse. Meningitis had developed. A spinal tap showed a cloudy fluid; the cell count was 11,000. No organism was present in a smear. Babinski and Kernig signs and rigidity of the neck were present. The diabetes was uncontrolled. Sulfadiazine was given intravenously. The progress of the disease indicated acute fulminating sinusitis with intracranial extension and severe diabetes. In spite of ample drainage following the Killian operation, chemotherapy and other measures, the general condition was getting worse.

Penicillin treatment was started. The administration of sulfadiazine was stopped. The patient's temperature was 104.4; the pulse rate, 104. Beginning January 7, the temperature dropped to 99 F. in about one and one-half days.

The dosage of penicillin was as follows: ten thousand units in 10 cc. of isotonic solution of sodium chloride was injected intraspinally every twelve hours for forty-eight hours, then every twenty-four hours. Fifteen thousand units was injected intramuscularly every three hours (eight times a day). The total daily dose was 140,000 units.

By January 6, the general condition of the patient was definitely improved. Meningitis was still present but less. The spinal fluid was not as turbid, and the cell count was 2,200. The temperature was lower. The wound was dressed, one suture was removed, the tube was gently irrigated and 5,000 units of penicillin in saline solution was instilled in the tube going to the frontal sinus.

January 7 crepitant rales and harsh breath sounds were heard in both lungs. The impression was bilateral pneumonia. At this point 5 Gm. of sulfadiazine was given intravenously. A roentgenogram of the chest showed extensive bilateral bronchopneumonia. There was consolidation of both lungs. (Roentgen examination on January 14 showed complete resolution of the bronchopneumonia.)

January 8 the general condition was definitely improved. The rigidity of the neck and edema of the forehead were less.

January 9 the patient was able to open the left eye.

January 11 the condition was worse. The patient had a period of mental confusion, with headache, twitching and other neurologic symptoms as well as cold sweats. Irritation of the frontal lobe seemed probable. The next few days the patient's progress was about the same.

January 15 he was drowsy, and attacks of twitchi the right side of the body were noted. The nex days there was not much change.

January 22, a little more than three weeks admission, his general condition was somewha proved. The cell count on the spinal fluid was roentgenogram showed a break in the cortex (oper of the upper part of the left frontal sinus, anterior with slight osteoporosis, which it was thought be due to recent infection of the bone. Osteom was diagnosed. The left ethmoid region illum better than before, with evidence of resection of Full roentgen views of the skull revealed no promi of vascular or convolutional markings. The g bone texture of the calvarium was normal. The p was rather drowsy and had some headache; the ri of the neck was much less. There was some edem the operative region.

A review showed that there was improvement cally as far as meningitis, spinal fluid changes count, rigidity and other neurologic observations concerned. The diabetic status was still mal (hard to control). Some intracranial infection still present in the left frontal region as evidenc headache, roentgen evidence, drowsiness and his g actions. The penicillin seemed to be controllin possibly curing the condition.

January 26 the local condition was improved. edema was less, and the wound was left exposed. eye appeared normal. The spinal fluid cell coun 100. In spite of the roentgen report of osteomyeli patient seemed to feel better and was brighter me

From January 26 to February 7 the patient s steady improvement and became more alert me The external wound was practically healed. The was cleansed internally. No pus was present.

February 7 roentgen examination showed acute myelitis of the frontal bone above the frontal with more involvement on the left. There was a increase in the osteolytic changes. No sequestrum visible. Clinically the patient showed improvemen cept for slight headache. The spinal fluid coun 30 cells. The patient was anxious to go home. out of bed. However, further observation was indi Treatment with penicillin had stopped on Januar From that date until February 8 the patient receiv penicillin.

February 8 he suffered from headache and vom Some weakness appeared in the right arm and th beginning localizing signs. The pulse was slow. headache was increasing, and there were signs abscess of the left side of the brain. The administ of penicillin was resumed.

February 9 Dr. Robert L. Moorhead and I unde an intracranial exploration. An angular incision made over the left orbit, the bone thinned and the exposed. Considerable softened bone was encoun Small granulating patches were observed on the A small incision was made in the dura. The f lobe was searched in all directions. A small a of fluid with flakes was evacuated. A rubber drai left over the dura and closure made.

Next day the patient's condition was only Paralysis of the right side of the face was incre Thereafter his condition became worse. He wen coma and died February 11, forty-eight hours aft operation.

Temperature Range (fig. 1).—The patient's perature was 101.4 F. on admission. It started t gradually the fourth day after admission and r 104.4 F. two days after the Killian operation. It s high for the next three days, then dropped sharpl was approximately normal to the day of death,

e sharply to 104.4 F. Treatment with penicillin tarted on January 5 at the height of the rise in rature, at which time meningitis was present; the rature dropped on January 7.

oratory Data.—The diabetic condition as reflected nary sugar and acetone and in blood sugar showed fluctuation. For example, on January 20 the blood was 444 mg. in the morning and 97 mg. in the oon.

blood count on admission was 3,350,000 red cells 4,350 white cells, with hemoglobin 85 per cent. nuary 13 the count was 4,100,000 red cells and white cells, with hemoglobin 97 per cent.

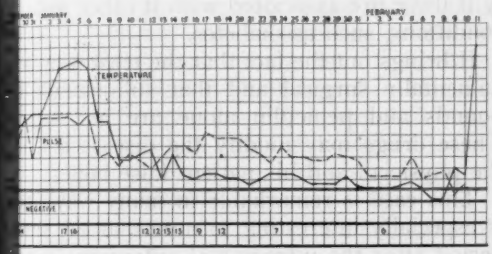
ue from the left frontal sinus showed chronically bacutely inflamed mucous membrane.

spinal fluid January 5 contained 11,000 cells per millimeter but no organisms. Sugar was present. ell count gradually became lower. On February 5, ll count was 30, and there were no organisms. reduction increased.

ture of blood showed no growth in forty-eight

blood sulfadiazine level January 5 was 9.2 mg. per d cubic centimeters; January 8 it was too low timation.

sedimentation rate was as follows: January 16, . in forty-five minutes (fast); January 24, 24 mm.



1.—Chart of the temperature and the pulse rate patient. Sulfadiazine was administered from Dec. 43 to Jan. 5, 1944. Penicillin therapy was started y 5. It was omitted from January 28 to February e total amount administered was 2,100,000 units. rgical treatment consisted of the Killian operation left frontal sinus January 3 and an exploration for s of the brain February 9.

ty minutes; January 31, 24 mm. in ninety-two s (showing diminishing infection).

ical Diagnosis.—The clinical diagnosis was acute usitis, meningitis, osteomyelitis of the frontal bone, s of the brain and diabetes mellitus (severe).

rapy.—For diabetes insulin and a diet were pre-d. Other treatment consisted of oral and intra- administration of sulfadiazine, four small blood usions, administration of penicillin (total dose, ,000,000 units) and two operations.

opsy (Dr. J. A. De Veer).—The patient died Feb- 11 and the postmortem examination, limited to the was made the same day. There was a recent tive wound in the left frontal area, the site of an atory operation. There had also been an opera- n the frontal sinus. When the calvarium was ed, the dural envelope was found tense, indicating ement of the brain. Since the dura was adherent t of the left hemisphere, the brain was removed the adherent dura in situ. Pus escaped from l sites during the removal, but its source was not gated until after fixation of the specimen in solu- formaldehyde. The brain was then sectioned in the frontal plane, from before backward at intervals of about 1 cm.

It was noted that the brain had been under increased pressure, as indicated by flattening and broadening of convolutions and narrowing of sulci. Over most of the surface, the dura and the arachnoid were free of adhesions and gross evidence of inflammation. However, the posterior half of the falx and the left leaf of the tentorium were firmly attached to the corresponding surfaces of the left cerebral hemisphere. The area of attachment marked the periphery of a circumscribed subdural collection of pus (a subdural abscess or purulent localized meningitis). There was thickening

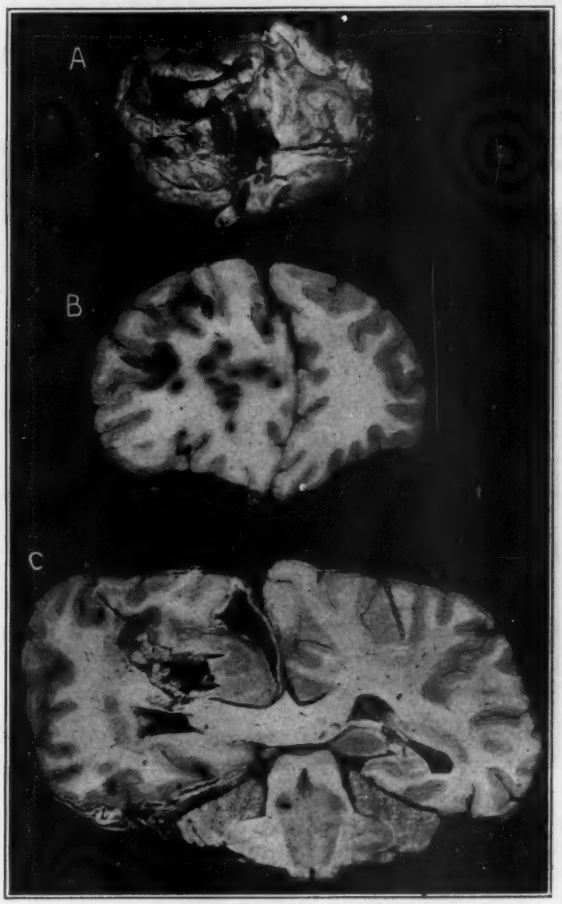


Fig. 2.—Brain sectioned in the frontal plane from before backward: *A,* tip of the frontal lobe showing thick adherent dura on the left side. This was the part of the brain nearest the left frontal sinus and frontal bone and the site of the exploratory operation. *B,* tracts produced by exploratory probing. These tracts ran back through the frontal and parietal lobes to about the midbrain. None of these tracts reached the anterior limits of the acute abscess of the brain shown in *C.* Note the shift of the midline of the brain to the right and the flattening and broadening of convolutions and the narrowing of sulci due to increased pressure. *C,* section showing two abscesses. One is a subdural or local meningeal abscess on the mesial and under surface between the falx and the tentorium. This abscess is older and has a thick capsule. It starts in about the midparietal region and runs backward. The second abscess is a fresh or acute abscess located in the white substance above the ventricular system posterior to the basal ganglions. It starts in the occipital pole and extends forward to the level of the anterior margin of the pons.

of the pia-arachnoid at the site of this abscess, but there was no frank evidence of erosion through the pia into the brain. Elsewhere the pia-arachnoid layers were thin.

A large acute abscess was found in the substance of the left hemisphere, extending from almost the tip of the occipital pole forward through the white matter of the hemisphere to the level of the anterior margin of the pons. The abscess lay above and slightly mesial to the body of the lateral ventricle, and there had been no rupture into the ventricle. The exact pathway by which this abscess was formed was not found but its posterior limit was within a few millimeters of the subdural abscess.

Tracts produced by the exploratory probing were followed from the left frontal pole into various parts of the frontal and parietal lobes and into the basal ganglions on the left, and one reached as far back as the infundibulum of the pituitary gland. None of these tracts reached the anterior limit of the intracerebral abscess.

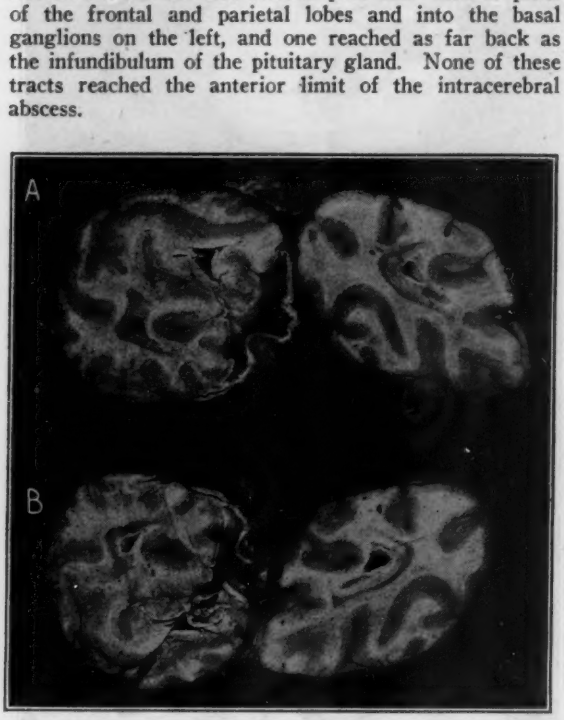


Fig. 3.—*A*, section showing acute abscess smaller as it goes toward the occiput. No communication with the subdural abscess is seen. *B*, section showing close proximity of the subdural abscess to the acute abscess with probable communication between them.

Anatomic Diagnosis.—The anatomic diagnosis was (1) chronic suppurative meningitis, localized (meningeal abscess), and (2) acute abscess of the brain.

PENICILLIN THERAPY

Since this was the first patient in a major otolaryngologic case to receive penicillin at the Brooklyn Eye and Ear Hospital, a few observations were recorded. The drug was released to the hospital through Dr. Chester S. Keefer, chairman of the Committee on Chemotherapeutic and other agents of the National Research Council. Dr. Keefer outlined the dosage and the method of administration. Numerous conversations with his office associates in Boston were held by telephone during the course of treatment. They advised conservatism as far as surgical intervention was concerned while the drug was used. The greatest benefit from penicillin received by patients under 40 years of age, out complicating disease, who were treate tensively early in the course of the infection.

In this case, as shown by the chart, 2,000,000 units was used. It was given i muscularly, intraspinally, topically and i venously. It was given mostly intramuscu as often as eight times a day. It was used and in conjunction with a sulfonamide There was a good clinical response, and it beneficial as to the meningitis and the healin the local wound, and it prolonged the sur period after the intracranial extension o infection.

COMMENT AND CONCLUSIONS

This case enables one to review some known facts regarding intracranial complica of sinusitis and presents material for thoug to the better management of such condition

It reminds one that acute frontal sinusitis be a serious and even dangerous disease, espe ly if there are associated with it other patho conditions, such as diabetes.

It brings out the fact that the treatment is damentally surgical and that sulfonamide pounds and penicillin alone are not suffic These drugs may modify the disease and l the physician and his patient false hopes.

This case is remarkable in many ways, a is especially interesting to note that the sur period after the intracranial extension (pur meningitis) was about six weeks. In a r series of 42 such fatal cases the average peri survival was one to seven days.[1] This long vival was credited to penicillin therapy.

The observations at autopsy were extre valuable. From the clinical course and find we expected to discover an abscess of the frontal lobe at operation. However, the abscess was in the occipital region and never municated with the frontal lobe. There wa evidence of direct extension either through posterior wall of the frontal sinus or through osteomyelitic frontal process to the epi space. The probable pathway of extensio was shown by the autopsy, was therefore m gitis which led to the subdural abscess w communicated with the tip of the occipital causing the formation of the acute abscess o brain which extended forward.

Finally, another problem is the localizatio infections of the brain and the determina of when to intervene surgically. Here again clinical and neurologic findings are often v and confusing, especially while chemothera being employed.

1. Courville, C. B.: Subdural Emphysema S dary to Purulent Frontal Sinusitis, Arch. Otola **39**:216 (March) 1944.

CONGENITAL DEAFNESS AND CATARACT FOLLOWING RUBELLA IN THE MOTHER

FRANZ ALTMANN, M.D., AND ALBERT DINGMANN, M.D., NEW YORK

1941 Gregg [1] reported from Australia a of 78 congenital cataracts in babies whose rs had suffered from rubella during the stages of pregnancy. The cataracts were of e nuclear type different in appearance from the morphologic types of congenital and pmental opacities reported previously. In the patients a congenital lesion of the heart lso detected.

ording to Swan and co-workers,[2] it appears when a woman contracts rubella during the wo months of pregnancy the chances of her birth to a congenitally defective child are er cent. If she contracts the disease in the month, the chances fall off to 50 per cent. disease occurs after the third month, there y a slight likelihood that the child will be nitally defective.

e abnormalities observed in the 41 children ned by Swan and co-workers in South alia were: microcephaly in 31, cardiac s in 21, cataracts in 15 (bilateral in 11, uni- in 4), deaf-mutism in 12, mental deficiency ental retardation, buphthalmos, mild hypo- s, talipes equinovarus and obliteration of le ducts in 1 each.

e defects occurred either in combination or .

e cases were not confined to Australia, a rather severe epidemic of rubella had ed in 1940; Reese [3] reported cases from York and Erickson [4] from Southern Cali- .

e high incidence of deaf-mutism (about 30 ent) makes the disease interesting for the yngologist. In the series of cases published wan and co-workers the disturbance of g was only three times combined with defects (heart disease); in 9 cases no other defect was present. This fact seems of great practical importance. It seems well possible that in certain cases of congenital deaf-mutism of hitherto undetermined cause the condition is actually due to rubella that occurred in the mother in the first stage of pregnancy.

An instructive case recently observed by us is briefly reported.

K. Sidney, 8 months old, was born at the normal end of pregnancy. His mother had contracted German measles during the latter part of the second month of pregnancy. When the child reached the age of 4 months, a congenital cataract on the right eye was removed by Dr. J. H. Dunnington, New York. The left eye showed clear media and some small pigmented spots around the disk. Lately the mother had noticed that the child did not react to sounds.

Examination showed a well nourished, well developed child. The internal findings were normal; there was no evidence of heart disease. Ears, nose and throat were without pathologic changes. No reactions to sounds could be elicited. On calorization with 10 cc. of ice water there was a normal response in each ear.

When last seen, at the age of 10 months, the child still showed no recognizable reaction to sounds.

COMMENT

In this patient complete loss of cochlear function was combined with unilateral cataract. Other malformations were missing. Among the 12 patients of Swan the hearing was completely lost only in 2; in the others the ability to hear high-pitched sounds still persisted. When speech was present, it was limited to a few words. The age of the patients made exact hearing tests impossible, but the impression was gained that examination at a later date would reveal hearing defects in a percentage still higher than 30 among the patients belonging to this group.

The patient whose case is reported in this paper is the only one in whom the vestibular function was tested. The fact that it was found to be normal could be regarded as a favorable sign.[5] Experience with other children suffering from deaf-mutism shows that those with unimpaired vestibular function, as a rule, have a larger amount of residual hearing than those in whom the vestibular function has been lost. The amount of residual hearing plays an important role in the learning of speech by the child.

The combination of deaf-mutism with cataract was not observed in any of the other cases. Swan and co-workers found that the time when

Gregg, N. M.: Congenital Cataract Following n Measles in the Mother, Tr. Ophth. Soc. Aus- 3:35, 1941.

Swan, C.; Tostevin, A. L.; Moore, B.; Mayo, H., lack, G. H. B.: Congenital Defects in Infants ing Infectious Diseases During Pregnancy, M. J. lia **2**:201, 1943. Swan, C.; Tostevin, A. L.; H., and Black, G. H. B.: Further Observations ngenital Defects in Infants Following Infectious es During Pregnancy, with Special Reference to a, ibid. **1**:409, 1944.

Reese, A. B.: Congenital Cataract Following n Measles in the Mother, Am. J. Ophth. **27**:483,

Erickson, C. A.: Rubella Early in Pregnancy g Congenital Malformation of Eyes and Heart, iat. **25**:281, 1944.

5. Since this article was written, another patient has been tested and the vestibular function again found normal.

the rash of rubella occurred in pregnancy in the mothers whose children showed deaf-mutism average two and three-tenth months and that the time in those whose babies had cataracts averaged one and four-tenth months. He thought that the nature of the congenital defect might depend on the stage of pregnancy in which the mother contracted rubella. The findings in our case show that the time of the onset of rubella cannot be the only determining factor.

Rubella occurring during early pregnancy is a serious disease and gives rise to many practical problems. Erickson makes the following gestions: Girls should not be allowed to through childhood without having contr rubella—a deliberate exposure at an oppor time would be deemed wise; the use of Ge measles convalescent serum for all women are in the early stages of pregnancy and hav had rubella should be considered, partic after exposure or during an epidemic; the fication for therapeutic abortion if rubella o during the first two months of pregnancy s be debated.

Clinical Notes; New Instruments and Technics

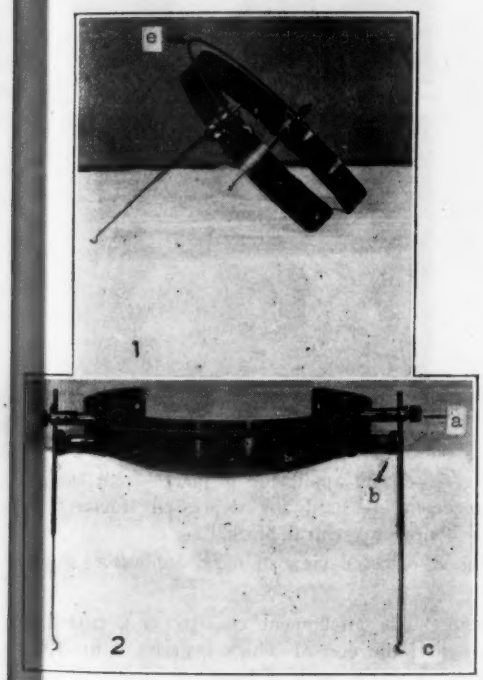
ODIFIED TRACTION AND FIXATION SPLINT FOR FRACTURES OF FACIAL BONES

LIEUTENANT COLONEL ALFRED WACHSBERGER
MEDICAL CORPS, ARMY OF THE UNITED STATES

ctures of the facial bones occur more frequently wartime. Injuries sustained in hazardous mechanical portation and gunshot wounds of the face are some the causes for the increased frequency.

The fractures are usually multiple, depressed and quently compounded through the skin or into the asal sinuses. The bones involved are the nasal, al and orbital bones, the zygomatic arch and the lar bone, the maxilla and the mandible. Proper ting of the fractures is mandatory for restoration functions like mastication and coordination of eye cles, as well as for cosmetic appearance.

Following are the requisite qualities of a splint: It be firmly yet comfortably fixed to the uninjured of the skull. It must be light in weight. There



1.—Side view of the headband with two sliding ings, hook attachments and horizontal bar (*e*). eadband is fastened with cord drawn through the at both ends.

2.—Front view of the apparatus with two mount- in lateral position: (*a*) upper hinged set screw; lower adjustment screw; (*c*) hook attachment.

be provision for multiple attachments, with each movable to any desired position around and distant the face. The amount of traction must be adjustable to a fine degree and without undue discomfort to the patient.

These requirements are believed to have been met in the splint presented. It represents a modification of the apparatus designed by Dr. John B. Erich,[1] of the

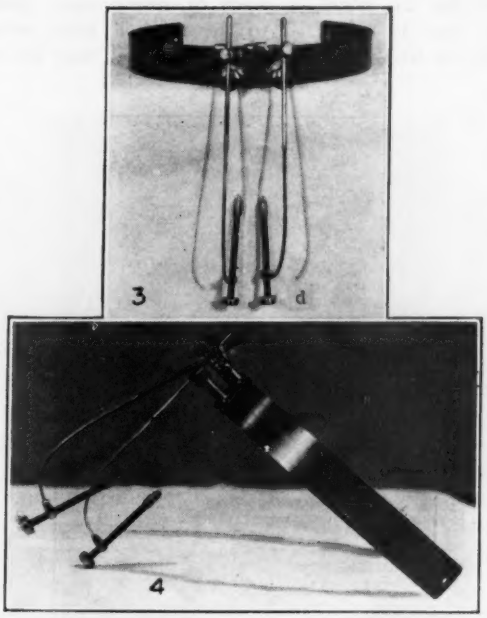


Fig. 3.—Two nasal attachments. The threaded part of the nasal applicator (*d*) may be covered with rubber tubing.

Fig. 4.—Side view of the splint with one nasal applicator adjusted in forward traction by means of the lower set screw. Note the hinge on the upper set screw.

Mayo Clinic, and Commander D. R. Womack, U.S.N.R.[2] It was designed by me and was constructed by Mr. Lynn A. Hodgert, of the Post Utility Branch of Hammond General Hospital.

DESCRIPTION OF THE APPARATUS

The apparatus consists in part of a metal band 1 inch wide and 19 inches long (2.5 cm. by 48 cm.). The one depicted here is a portion of a clock spring. However,

1. Erich, J. B., and Austin, L. T.: Traumatic Injuries of Facial Bones, Philadelphia, W. B. Saunders Company, 1944.

2. Womack, D. R.: A Fracture Device for the Nose, U. S. Nav. M. Bull. **41**:852 (May) 1943.

any other metal may be used, and it may be perforated in order to lighten the weight.

Each mounting slides onto and along the headband to any desired position. Attached to each mounting are an upper and a lower screw. The upper (*a* in fig. 2) is hinged and permits rotation around a horizontal axis. The hinged outer portion has two horizontal and one vertical boring for introduction of attachments. A set screw holds the attachment in place. The lower screw (*b* in fig. 2), which is attached to the mounting, adjusts the amount of traction desired to a fine degree. This may be done with the apparatus in place and eliminates the pain usually experienced during the adjustment with the rubber bands generally used.

The attachments are of two kinds: A plain hook (*c* in fig. 2), which is made of spring steel (piano wire) and is connected to the fixation wire, which hooks on to the depressed fragment. It may be adjusted in an up and down direction or rotated around the vertical axis by adjustment of a set screw. The spring steel wire may be bent for further adjustment.

Fig. 5.—Splint invested in a plaster headcast with a hook attachment for traction of a depressed compound (into right antrum) fracture of the right malar bone. The wire is introduced through the lower eyelid, the floor of the orbit, the antrum, the fracture line of the anterior bony wall of the antrum and out through the cheek. A bone screw in the malar bone may be used in place of the wire when feasible.

Fig. 6.—Side view. Note the extension of the plaster cast below the occipital protuberance. The traction wires as they emerge are guided by a Lane bone plate to prevent injury to the skin.

This attachment is principally used for fractures maxilla, the mandible, the malar bone and the matic arch. The sliding mounting together wi attachment is placed behind the ear for posterio tion on a fractured mandible. Several of these may be used simultaneously for multiple or b fractures.

The second attachment (*d* in fig. 3) is desig the traction and fixation of depressed fractures nasal bone or for "central block" of the middl of the facial bones. This term is used by Fry co-workers for fractures which comprise the na ethmoid bones, the medial parts of the maxillas

Fig. 7.—Nasal applicator in place—front view arrangement is used for depressed fractures nasal bones or "central block."

Fig. 8.—Profile view of nasal applicators in

septum. The attachment consists of a curved steel wire, the end of which contains a thread holding a screw with a blunt, olive-shaped tip latter is inserted into the nose and is adjus several ways: Vertical adjustment is accom either by adjusting the set screw on the sliding ing or by setting the nasal applicator itself threaded part may be covered with rubber Lateral traction is accomplished by either slid mounting to a lateral position or by rotating the ment on the vertical axis and fixing it in the

3. Fry, W. K.; Shepherd, P. R.; McLeod, and Parfitt, G. J.: The Dental Treatment of Facial Injuries, Philadelphia, J. B. Lippincott pany, 1943.

n with the set screw. Traction can thus be plished in any and all directions with the finest g. Traction can also be accomplished with the set screw on the sliding mounting (fig. 4). In n to all the aforementioned adjustments, the itself may be bent.

horizontal bar (*e* in fig. 1) may be used in addi- the other attachments. This is inserted through orizontal boring of the upper screw and may be for the attachment of additional traction wires in everest forms of multiple comminuted fractures.

The entire apparatus is invested in a plaster head-cast, requiring about four layers of a 2 or 3 inch (5 or 7.5 cm.) wide plaster bandage. A stockinet protects the hair from the plaster and pieces of felt over the frontal and the parietal protuberances relieve pressure on the skull. The apparatus is light in weight and causes the patient no undue discomfort.

Adaptability for fixation and traction of any kind of fracture of the facial bones and easy adjustment of the direction and the amount of traction needed present distinct advantages over similar splints in use. It is easily constructed, a factor which is important in military medicine.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

CONTRIBUTIONS TO PLASTIC SURGERY DURING 1944

LYNDON A. PEER, M.D.
NEWARK, N. J.

The literature on plastic surgery for 1944 contains numerous contributions on surgical technic, some reports of important investigative work and a few articles dealing with the principles involved in planning reconstructive surgical procedures.

Most important among the latter group is the article published by Ferris Smith in which he urges simplification of plastic procedures along rational lines. He emphasizes that many types of facial disfigurement can be repaired by multiple excision or by using flaps of facial skin from the vicinity of the defect rather than grafts of foreign skin from elsewhere on the body surface. When the loss of facial skin is so extensive that the condition cannot be corrected by sliding or rotating skin from the face or the neck into the defect, then only may foreign skin flaps or free grafts be used. This foreign skin forms a satisfactory functional covering and relieves the tension caused by the scar, but it never matches the color of the facial skin.

Hance and her associates contribute a method of "tattooing" these white skin grafts with pigments so that they blend with the surrounding facial skin and are thus rendered less conspicuous.

Among the investigators Webster merits recognition for his work on refrigerated skin grafts.

A large number of authors report on the fixation of skin grafts and the control of bleeding in the recipient site by the topical application of thrombin in conjunction with plasma or fibrinogen. The technic is probably indicated for awkward locations in which it is difficult to obtain adequate fixation of the graft by pressure. There is still insufficient evidence to warrant the statement that the thrombin method of fixation of skin grafts results in a higher percentage of "takes" than is obtained when the suture-compression method is used.

A study of the treatment given to the wounded in the Army and the Navy hospitals visited by the reviewer indicates careful planning, skilful technic in operative repairs and satisfactory results. There is excellent cooperation bet the plastic surgery departments and other sp surgical services, and good plastic-dental work is evident in the treatment of injuri the jaws.

EXPERIMENTAL AND CLINICAL INVESTIGATI

Sulfonamide Drugs and Other Antibac Agents.—Crowe [1] summarizes the cardinal ciples of chemotherapy as follows: All infec organisms, both aerobes and anaerobes, mus identified; the bacteria must be sensitive to drug or a combination of drugs used, and, fi the drug must come into direct contact with bacteria in the tissues in an adequate con tration and over a sufficient period to allow plete bactericidal or bacteriostatic effect. acute spreading infections sulfonamide c pounds taken by mouth or penicillin inje intravenously or intramuscularly are us most satisfactory, but in chronic infection mucous membrane or bone much of the effect ness depends on the accessibility of the infec bacteria to the action of the drug.

According to Faison,[2] the use of penicill indicated in all infections, either localized generalized, that are caused by gram-posi organisms and gram-negative cocci, but p cillin is useless against gram-negative ba Thus, the type of organism must be determ bacteriologically before penicillin is administe

Reports in the literature described the succ ful use of penicillin (1) in gonorrhea (129 ca all patients were cured and 125 had nega cultures within nine to forty-eight hours); in primary syphilis; (3) in actinomycosis; in tetanus, in which penicillin prevents the

1. Crowe, S. J.: The Local Use of Sulfadi Solution, Radon, Tyrothricin and Penicillin in Otola gology, Ann. Otol., Rhin. & Laryng. **53**:227 (June)

2. Faison, E. S.: The Present Day Knowledg Penicillin, North Carolina M. J. **5**:97 (March) 194

duction of toxins although it cannot neutralize existing toxins; (5) in staphylococcic septicemia, and (6) in osteomyelitis.

In the opinion of Christie and Garrod,[3] the antiseptic action of penicillin is exerted only against certain bacteria. Susceptible bacteria are almost all gram-positive, the chief exceptions being the gonococcus and the meningococcus. The gas gangrene group of bacteria, including Clostridium oedematiens, Bacillus anthracis and some strains of Streptococcus viridans and Actinomyces have also been found susceptible in vitro. More or less resistant species include almost all gram-negative bacilli, including Bacillus pyocyaneus, which is often found on infected granulating surfaces.

Mowlem[4] believes that local thrombosis of the main vessels supplying the inferior and the superior maxilla is an important factor in inducing invasion of the bone by organisms in the oral cavity. The author suggests that this local thrombosis is caused either by direct trauma to the inferior dental vessels during the removal of a tooth or by central extension of thrombosis in the vessels supplying either the root of a tooth or surface structures. Penicillin is unlikely to give bacteriologic control in the presence of necrotic sequestrums or unfavorable surgical conditions. It is therefore no substitute for adequate surgical treatment. Penicillin used as a prophylactic agent has led to the conversion of the original open method of treatment to a closed one. In the cases in which the patients were treated by the closed method, elimination of all penicillin-sensitive organisms, satisfactory healing of the soft tissue and good regeneration of the bone took place, so that recovery from what has hitherto been an extremely chronic condition was effected in approximately thirty days.

Although sulfonamide drugs are of great therapeutic value, the numerous reports on the toxic effects of these compounds are evidence that the dosages are dangerous as well as life saving. Lyons and Van Harn[5] believe that the danger lies not only in the immediate toxic effects but also in the remote effects, which may be even more serious. Too little consideration is often given to the possibility of producing a sensitivity to the drug that may make the subsequent use of a sulfonamide compound dangerous or contraindicated when the patient is suffering from an infection for which sulfonamide therapy might be life saving.

The effective dosage of sulfamerazine is one-half to one-third that of sulfadiazine, according to Anderson and his associates.[6] The incidence and the frequency of toxic reactions are about the same for both drugs, except that leukopenia, cutaneous eruptions and fever are more apt to occur from the use of sulfamerazine. Sulfamerazine is more valuable than sulfadiazine, as it is more rapidly and completely absorbed from the gastrointestinal tract, and is more slowly excreted by the kidneys.

McIndoe and Tilley[7] stress the importance of a persistent streptococcic infection in granulating areas that are to receive skin grafts. The authors applied 0.1 per cent propamidine (4,4′-diamidinodiphenoxy-propanedihydrochloride) to granulating areas infected with streptococci, and after obtaining three successive cultures negative for these micro-organisms, they applied skin grafts to the areas. The application of propamidine served to eradicate the streptococcic organisms but did not affect the staphylococcic organisms, the presence of which in some cases interfered with the complete take of the graft.

Farley[8] announces the discovery of a new enzymatic agent which seems to have remarkable bactericidal properties. This agent is called canavalin; in vitro it renders both gram-positive and gram-negative organisms incapable of growth.

Burns and Shock.—The logical treatment of burns, in Koch's opinion,[9] is based on three simple premises: 1. A burn is essentially an open wound involving the superficial tissues and is subject to the same serious complications—infection and hemorrhage. 2. Both infection and hemorrhage can be prevented by well directed treatment at the very outset. The essential requirements of such treatment are surgical cleanliness, compression of the injured surface to prevent loss of fluid and rest. 3. If the injury has resulted in complete loss of covering tissues, re-

3. Christie, R. V., and Garrod, L. P.: A Penicillin Therapeutic Research Unit, Brit. M. J. **1**:513 (April 15) 1944.

4. Mowlem, R.: Surgery and Penicillin in Maxillar Infections, Brit. M. J. **1**:517 (April 15) 1944.

5. Lyons, R. H., and Van Harn, R. S.: Problems of Toxicity in Sulfonamide Therapy, J. Oral Surg. **2**: 118 (April) 1944.

6. Anderson, D. G.; Oliver, C. S., and Keefer, C. S.: A Clinical Evaluation of Sulfamerazine, New England J. Med. **220**:369 (March 30) 1944.

7. McIndoe, A. H., and Tilley, A. R.: Propamidine in Chronic Streptococcal Infections of Raw Surfaces, Lancet **1**:136 (Jan. 30) 1943.

8. Farley, D. L.: Canavalin: A New Enzymatic Bactericidal Agent, Surg., Gynec. & Obst. **79**:83 (July) 1944.

9. Koch, S. L.: Surgical Cleanliness, Compression and Rest, in the Treatment of Burns, J. A. M. A. **125**: 612 (July 1) 1944.

placement at the earliest possible moment is most certain to result in prompt healing with maximum retention of function.

On the basis of experimental work with animals, Figueroa and Lavieri [10] conclude that pectin is nonantigenic and nontoxic and is retained in the circulation longer than solutions of crystalloids. It prevents the onset of shock in experimental animals for a longer time than does an isotonic solution of sodium chloride or dextrose used alone. The results of these experiments indicate that a solution of pectin may be employed as a substitute for plasma or whole blood when the latter fluids are not available.

From their experimental work with animals Berman and his colleagues [11] reached the following conclusions: Isotonic sodium chloride solution injected hypodermically into the burned area reduces the loss of plasma and electrolytes, makes possible the dilution and excretion of hypothetic toxins, controls body temperature and prevents pulmonary edema and anuria. As a result of these effects survival time is considerably increased in the treated animals.

In a discussion of the healing of wounds Cope [12] emphasizes the fact that no chemical agent is known which expedites such healing above the physiologic optimum prevailing in the state of normal nutrition and the absence of infection. Substances such as biodyne, vitamin ointments and light filters are foisted on physicians under the mistaken impression that they accelerate cellular regeneration. Critical analysis does not confirm these claims.

Harkins [13] advises the application of a sterile compression bandage as the most effective treatment for thermal burns at the present time. In all third degree burns the resulting granulating surfaces should receive skin grafts as soon as possible.

Gurd and Gerrie [14] discuss the early care of deep burns and draw the following conclusions:

1. Grafting of skin on the affected area at the earliest possible moment is one of the chief aims in the treatment of burns. Such a proc minimizes protein loss, prevents contrac and maintains the morale of the patient.

2. An occlusional pressure dressing with per cent sulfathiazole oil in water emulsio been helpful in achieving this result.

3. Delayed primary skin grafting betwee tenth and the fortieth day is the usual te Occasionally immediate primary skin gr may be indicated.

4. Isodermal skin grafting has a limited bu haps valuable use.

Experimenting with dogs, Roback and made a study of the therapy of burns. They clude that medicated pliable sheets of g and a firmly applied gauze or cotton dressing be used in the treatment of burns and may to be more desirable than other preparations employed in the management of burns an tensive cutaneous wounds. The authors' o vations do not indicate that the procedu superior to a firmly applied boric acid oint dressing in respect to the time required for plete epithelization.

Lee and Rhoads [16] remark that seldom history of surgical therapeusis has a new m been introduced into an important field of cine and swept all other methods into disu completely as did the method of applying t acid in the treatment of burns. The advanta tannic acid is that its application often post infection for at least a week, so that the p passes through the period of shock and th much of the period of toxemia before infe develops. The disadvantages are the de tive action of tannic acid on surviving epith and the danger of damage to the liver fro sorption of the drug.

Miscellaneous Investigations.—Working animals, Beyer and his associates [17] found vitamin C deficiency caused guinea pigs brought more quickly to a state of anesthesi to be depressed more deeply by a given co tration of ether, chloroform or vinethene normal animals. The animals deficient in vi C recovered slowly, if at all, from a durati anesthesia which had little apparent after on those which had received the same scor

10. Figueroa, L., and Lavieri, F. J.: The Use of Pectin and Other Agents to Prevent Shock, Surg., Gynec. & Obst. **78**:600 (June) 1944.

11. Berman, J. K.; Peterson, L., and Butler, J.: The Treatment of Burn Shock with Continuous Hypodermoclysis of Physiological Saline Solution into the Burned Area, Surg., Gynec. & Obst. **78**:337 (April) 1944.

12. Cope, O.: The Chemical Aspects of Burn Treatment, J. A. M. A. **125**:536 (June 24) 1944.

13. Harkins, H. N.: The Problem of Thermal Burns, J. A. M. A. **125**:533 (June 24) 1944.

14. Gurd, F. B., and Gerrie, J. W.: The Early Plastic Care of Deep Burns, J. A. M. A. **125**:616 (July 1) 1944.

15. Roback, R. A., and Ivy, A. C.: The Ther Burns, Surg., Gynec. & Obst. **79**:469 (Nov.) 194

16. Lee, W. E., and Rhoads, J. E.: The P Status of the Tannic Acid Method in the Trea of Burns, J. A. M. A. **125**:610 (July 1) 1944.

17. Beyer, K. H.; Stutzman, J. W., and Haffor The Relation of Vitamin C to Anesthesia, Surg. & Obst. **79**:49 (July) 1944.

diet but had been given 30 mg. of ascorbic daily by injection.

Lange [18] describes a new method of determining the circulation in ulcers, skin grafts and skin In this procedure the patient is given an intravenous injection of 10 cc. of a 5 per cent fluorescein solution to which 5 per cent sodium carbonate has been added to make it soluble. The dye is entirely nontoxic and is rapidly excreted into the urine. Under ultraviolet rays the ulcer or skin flap will acquire an intense yellowish green color in all regions which are supplied by rapid circulation. A clear contrast is thus created, showing the parts of the ulcer or skin flap that are supplied with circulating blood.

Uhlmann [19] advises the use of alpha rays in the treatment of ulcers in which the local blood supply has been impaired. The alpha rays are combined in a prepared radon ointment. They are especially indicated for the treatment of cutaneous burns and ulcerations that have resulted from overdosage of roentgen rays and radium.

Seddon and Holmes [20] report 4 human nerve homografts all of which were failures. They believe that the failure of such grafts in man is probably due to the development of a specific tissue immunity such as seems to be responsible for the destruction of cutaneous homografts. Blood group incompatibility is an unproved and improbable factor.

Methods of nerve suture are discussed by Tarlov.[21] He states that satisfactory results may be obtained by the use of tantalum wire or silk sutures. In some instances, however, it seems likely that fibrosis at the suture line or misalignment of nerve ends may be a factor in accounting for the imperfect results. In the author's experience the combined technic of tantalum wire and autologous plasma clot overcomes many of the objections to the use of any type of end to end apposition suture.

SKIN GRAFTING

Smith [22] has been urging a simplification of plastic procedures along rational lines for a number of years, and in the January issue of *Surgery* he again advises adherence to certain fundamental principles of obtaining, transferring and utilizing the various covering and supporting tissues.

He advises against the use of skin flaps or of free skin grafts on the face except as measures of necessity, since these transfers create additional scarring in the area from which the skin graft is removed, and the grafted skin on the face is often conspicuous and unsightly. He believes that many types of facial disfigurement can be successfully repaired by multiple excision and by the Z plastic procedure, in which flaps of normal skin from the vicinity of the deformity are employed.

Comment.—Smith's plea for simplification of facial plastic procedures has influenced the approach of many plastic surgeons to the problems of facial repair.

Over a period of eight years the injection of pigment into the skin has been used by Hance and her co-workers [23] to match the color of free skin grafts to surrounding facial skin. This method has been used with 27 free skin grafts and 8 skin flaps, and in 10 instances to simulate the missing vermilion border of the lip. The authors report that the appearance of the surgical repair has been definitely improved in every case, sometimes markedly so. There have been no complications or bad results from the procedure.

Comment.—As emphasized by Smith, skin grafts transplanted to the facial area from parts of the body surface other than the face and the neck blend poorly with the surrounding facial skin. Unfortunately, extensive loss or scarring of the facial skin in some patients can be repaired only with skin grafts from the chest, the abdomen, the thighs or the arms, and this skin will appear whiter than the surrounding facial skin. The authors have contributed a valuable method of giving these white skin grafts a color that will blend with the neighboring area.

Webster [24] reports 23 cases in which refrigerated skin was applied on 36 occasions. Four of the grafts were of full thickness skin and the remainder of split thickness. All of the grafts transplanted were autogenous except 5, which were homogenous. Most of the autografts were transplanted after refrigeration of less than twenty-one days, and these were largely successful. All of the autografts refrigerated over three weeks "melted away" as do homogenous skin grafts.

The technic of refrigeration is to fold the skin grafts together so that the raw surfaces are in

18. Lange, K.: The Vascular Prerequisite of Successful Skin Grafting, Surgery **15**:85 (Jan.) 1944.

19. Uhlmann, E. M.: Alpha Rays in the Treatment of Wounds, Surg., Gynec. & Obst. **79**:412 (Oct.) 1944.

20. Seddon, H. J., and Holmes, W.: The Late Degeneration of Nerve Homografts in Man, Surg., Gynec. & Obst. **79**:342 (Oct.) 1944.

21. Tarlov, I. M.: Autologous Plasma Clot Suture of Nerves, J. A. M. A. **126**:741 (Nov. 18) 1944.

22. Smith, F.: Planning the Reconstruction, Surgery **15**:1 (Jan.) 1944.

23. Hance, G.; Brown, J. B.; Byars, L. T., and McDowell, F.: Color Matching of Skin Grafts and Flaps with Permanent Pigment Injection, Surg., Gynec. & Obst. **79**:624 (Dec.) 1944.

24. Webster, J. P.: Refrigerated Skin Grafts, Ann. Surg. **120**:431 (Oct.) 1944.

contact, thus preventing excessive evaporation. The folded grafts are then wrapped in film, and this packet is subsequently sealed in several layers of petrolatum to prevent the grafts from drying. This package is further folded in towels, marked with the patient's name and the date and placed in the refrigerator at approximately 4 C.; the ordinary refrigerator is satisfactory for this purpose.

The methods available for replacing sk the face are discussed by Gillies and Cuth Free grafts are particularly indicated for th rection of cicatricial ectropion of the eyeli certain cases in which loss of skin is not e sive, the use of local flaps will often give a ing result. The local flap should be emp with discretion as it necessitates the prod of additional linear scarring, but to co

Fig. 1.—*A,* scar from a third degree burn. Note destruction of the nasal skin of the left ala and the h trophied scar and keloid. *B,* nose covered with whole thickness skin from the mesial surfaces of the ears. plastic procedure has placed normal skin in position for multiple excisions of the hypertrophied scar on the *C,* appearance as the reconstruction nears completion; the Z plastic procedure for removal of the scar on the incomplete. (Adapted from Smith.[22])

The main advantage of the method is that it permits the storage of excess remnants of skin for future use and divides a long hazardous operation into two or more less taxing stages.

balance this disadvantage the matching of is perfect.

25. Gillies, H., and Cuthbert, J. B.: Plastic Su Bristol, John Wright & Sons, Ltd., 1943.

Gillies and Cuthbert advise forehead flaps for replacement of large nasal losses since the match in texture and color are extremely good. Flaps of abdominal skin carried to the face, the wrist or arm being used as the intermediate attachment, or an acromiothoracic pedicle flap is suitable for replacing large areas of skin.

In a discussion of free skin grafts in surface defects Straatsma [26] states: In the treatment of a large number of surface defects resulting from war injuries, the split skin graft is the most practical because of its availability, its surety of take and its lack of disfigurement at the donor site. The full thickness graft, except when small and taken from similarly exposed areas, is impracticable not only because of the color difference but also because of the destruction at the donor site.

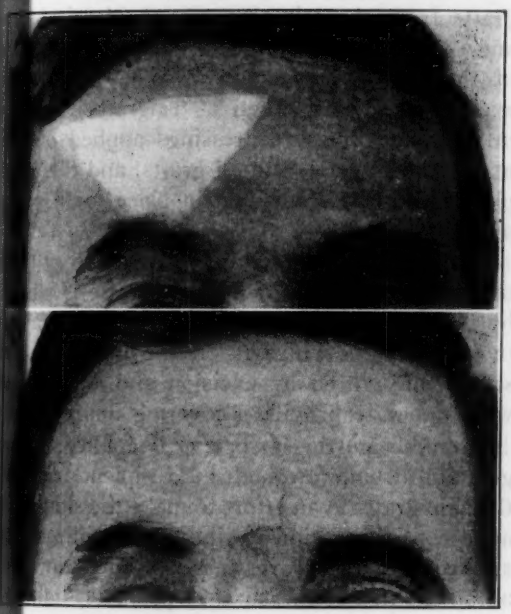


Fig. 2.—*A*, completely white skin graft on the forearm. *B*, result obtained soon after injection of pigment. The mottled appearance disappears as the pigment diffuses slightly with time. (Adapted from Hance and co-workers.[28])

The epithelial graft is good for the repair of mobile surfaces and the lining of cavities, but because of its thinness it does not prevent scar contracture when applied over large areas.

Following a comprehensive discussion of the various types of skin grafts Greeley [27] concludes: Free grafts must always be given first choice for reasons of simplicity and when there is a healthy base against which pressure can be exerted. A split skin graft will serve to cover the greater majority of all cutaneous defects. This type of graft is identical in consistency and character whether it has been removed with a dermatome or a razor.

Pedicle grafts are necessary (1) when it is doubtful whether the viability of the graft can be maintained, (2) when a subcutaneous fat pad is to be transferred with the cutaneous covering and (3) when both lining and cutaneous covering are needed.

The simple pedicle flap is most suitable when it can be rotated from an area nearby. Tube pedicle flaps are chosen when the skin is to be obtained from some distant point.

All types of scars may follow the healing of burns, according to Davis.[28] The vast majority of these deformities must be treated by operative methods. The most important of the methods are: excision with closure by sutures; excision with lateral relaxation incision, and closure followed by skin grafting of the relaxation defects; gradual partial excision with closure; relaxation incisions in the scar itself, with skin grafting; the use of Z plastic procedures; the application of pedicle flaps.

In many instances it is impossible to excise the scar completely, on account of its size and location. In these cases the utilization of the scar itself or of scar-infiltrated tissue in making the final repair is essential.

Lamont [29] advises early grafting of skin on areas of third degree burns to save life and to prevent extensive deformities due to contracture. The operative procedures must be governed, however, by the patient's general condition. Improvement of the diet and of the intake of fluids, administration of vitamins and other supportive measures to increase the general body resistance and the condition of the skin should be instituted as an important course before the time for operation is selected. Blood transfusions prior to carrying out skin grafting may be of great value.

Aufricht [30] warns that in the treatment of facial scars foreign skin has its esthetic shortcomings and is far from being a perfect match for the normal facial skin. Therefore, in mild cases of scarring it is of paramount importance to know one's limitations and advise against opera-

26. Straatsma, C. R.: The Role of Free Skin Grafts in Surface Defects, S. Clin. North America **24**:309 (April) 1944.

27. Greeley, P. W.: Factors Influencing the Choice of Skin Grafts, U. S. Nav. M. Bull. **42**:659 (March) 1944.

28. Davis, J. S.: The Late Plastic Care of Burn Scars and Deformities, J. A. M. A. **125**:621 (July 1) 1944.

29. Lamont, H. A.: Early Skin-Grafting of War Wounds, U. S. Nav. M. Bull. **42**:654 (March) 1944.

30. Aufricht, G.: Evaluation of Pedicle Flaps Versus Skin Grafts in Reconstruction of Surface Defects and Scar Contractures of the Chin, Cheeks and Neck, Surgery **15**:75 (Jan.) 1944.

tion. If one or two contracting bands are present, shifting of the skin by a Z plastic procedure is sufficient in suitable cases.

Plastic surgery can offer real relief, however, in extensive defects of the chin, the cheeks and the neck caused by scar contracture. Severe roentgen ray or radium burns with ulceration, considerable pain, and danger of malignant changes are also conditions in which conservative treatment must cease in favor of radical surgical intervention. Aufricht believes that the best esthetic results are still obtained by the use of tube flaps, but that free grafts are often indicated to avoid expense and long periods of hospitalization.

Webster [31] describes a technic for removing skin grafts with the Padgett dermatome in which a transparent film is first cemented to the drum surface. Rubber cement is then applied to the film, so that when the graft is cut it adheres to the surface of the film. After the film with the adherent skin graft has been removed from the drum surface, the graft is prevented from contracting by the presence of the inelastic film to which it is fastened. The skin graft with the attached film is applied over the recipient area and sutured by the overlap method or by the more time-consuming edge to edge method. If the wound is not absolutely dry and a moderate amount of fluid is expected to collect, slits should be made in the film and graft to permit drainage. In areas exposed to view, where appearance is especially important, satisfactory hemostasis should be obtained before the film-graft is applied so as to obviate unnecessary scarring from large slits.

Applying Webster's [31] principle of film-cemented skin grafts Hardy and McNichol [32] provided many separate film-covered skin grafts for use on granulating surfaces after the manner of pinch grafts. The method includes the removal of the graft on transparent film (pliofilm),[31] a thin tough transparent membrane, by means of the Padgett dermatome, the sectioning of the skin graft into pieces of about the size of a postage stamp or smaller and the application of these pieces to the granulating surfaces, approximately 1 cm. apart. The membrane which covers each graft facilitates the application of the latter by maintaining the normal tension of the skin and by preventing the edges of the graft from curling.

31. Webster, J. P.: Film-Cemented Skin Grafts, S. Clin. North America **24**:251 (April) 1944.

32. Hardy, S. B., and McNichol, J. W.: The Use of Small Pieces of Film-Covered Skin Grafts, S. Clin. North America **24**:281 (April) 1944.

According to McIndoe,[33] split skin grafts the most satisfactory of all free grafts for b of the head, the face and the neck. Ped flaps are indicated to cover poorly vascula surfaces where bare bone is exposed. Exper shows that the use of a pedicle flap is ofte long delayed and that the patient lies in a pital for months while unavailing efforts made to bring free grafts to the state in w they take.

Working with Canadian Industries Lim Gerrie [34] has produced a cement of the n cellulose group for use on the Padgett derma and Caltagirone skin-grafting equipment. S this cement has a greater affinity for metal for skin, the skin is stripped away cement leaving the cement on the metal.

Schattner [35] removed two full thickness grafts from the left arm of one identical and two full thickness grafts from the right of the other identical twin. The grafts exchanged (transplanted as isografts), sut in place and pressure dressings applied. A mary take was noted in all grafts, and the t planted skin has remained in place for a p of two months.

Complete excision as the best method of t ment in many cases of lupus vulgaris is ad by Hollander and Shelton.[36] They report a in which lupus vulgaris on the upper lip successfully cured by excision and a skin was applied to provide a covering for the d

Cronkite and his associates [37] applied fibr gen and thrombin to both the recipient area the skin grafts in an effort to make the skin g adhere to the recipient sites. The authors applied a pressure dressing over the skin g as an additional measure to promote "take the grafts. Eight cases are reported in w skin grafts were successfully transplanted in way.

Comment.—The actual value of fibrinogen thrombin as an aid for the "take" of skin g is not demonstrated in this article. It is possible to have eight or more consecutive

33. McIndoe, A. H.: Skin Grafting in the T ment of Wounds, Proc. Roy. Soc. Med. **36**:647 (1943.

34. Gerrie, J.: A New Cement for Use in C Skin Grafts, Canad. M. A. J. **51**:465 (Nov.) 1944.

35. Schattner, A.: Report of Isograft Trans in Identical Twins, Arch. Otolaryng. **39**:531 (1944.

36. Hollander, L., and Shelton, J. M.: Replace Graft in Surgical Treatment of Lupus Vulgaris, Dermat. & Syph. **49**:60 (Jan.) 1944.

37. Cronkite, E. P.; Lozner, E. L., and D J. M.: Use of Thrombin and Fibrinogen in Grafting, J. A. M. A. **124**:976 (April 1) 1944.

take completely when pressure alone is over the grafts.

rick and Warner [38] state that fibrin fixa- f tissue in operative procedures can be ac- ished readily by the use of plasma and ed thrombin. In their experience, arti- supplied fibrin clots, obtained in this er, have proved to be of distinct mechanical skin-grafting operations.

report on the use of fibrin foam [39a] with bin is made by Ingraham and Bailey.[39b] is a new absorbable hemostatic agent pre- from fibrinogen and thrombin of human plasma. Extensive clinical use of fibrin with thrombin in neurosurgical operations hown it to control oozing from the dura, beneath bone flaps and from the cerebral s as well as from the dural sinuses and large s. It is not recommended for brisk arterial ing. Fibrin film [39a] in the form of a homo- us sheet has proved effective in the repair ral defects and in the prevention of menin- ebral adhesions.

cording to Young,[40] split thickness grafts be fixed on fresh wounds or granulating through the precipitation of fibrin between graft and the bed by adding thrombin to a. The normally expected "take" on surgical beds is obtained by this method. ranulating beds the percentage of "takes" ver than normally expected. The author be- s that the method is useful (1) in applying s on fresh surgical beds, (2) as a method lding grafts in position while compression ings are applied and (3) as a means of ing small grafts where compression dress- are ordinarily not used.

mment.—This article represents an attempt curate evaluation of the plasma-thrombin od of fixation for skin grafts by an ex- nced observer.

SURGERY OF THE NOSE

linger [41] pointed out that the conventional ucous resection is not adequate to correct itions in which the septal cartilage is buckled or curved away from the midline causing scoliosis of the nasal bridge. In this type of case, the entire nasal bridge being deviated, it is necessary to refracture the nose in order to bring the bony arch back to the midline and with it the perpendicular plate of the ethmoid.

Occasionally the lower half of the nasal dorsum will be depressed as a result of buckling of the cartilage and no amount of maneuvering can effectively restore the proper height. In these cases at a later date insertion of a cartilage graft will be required to fill the defect.

Salinger advises the Metzenbaum technic for certain types of septal displacement, and for others he uses a procedure which he himself has devised. He recommends that the mucous membrane should be left adherent on one side of the cartilage in operations necessitating replacement of the lower end of the septal cartilage toward the midline.

Comment.—The work of Dr. Salinger is well known and respected by my colleagues and me, but we do not feel as strongly as does the author about the necessity of leaving mucous membrane attached to one side of a displaced segment of septal cartilage that is to be set in proper position. Our experience does not indicate that it is necessary for the preservation of the septal cartilage, which is in effect a cartilage graft.

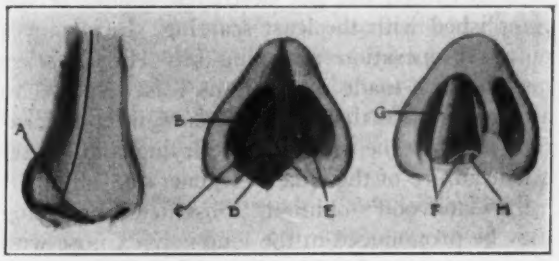


Fig. 3.—Diagram explaining the technic for removal of obstruction due to fracture involving the lower end of the septal cartilage: *A*, angulation of the lower end of the septum. *B*, angle of deviation seen from below; corresponds to *A*. *C*, lower end of the septal cartilage blocking the right vestibule. *D*, deviated vomer. *E*, septal border projecting into the left vestibule. *F*, right and left mucosa as exposed by the speculum; only the left mucosa has been freed; the right mucosa is still adherent. *G*, angle of deviation exposed after removal of deviated cartilage and mucosa. *H*, crest of vomer, which is removed to permit repositioning of the cartilage. (After Salinger.[41])

According to Gurdin,[42] a diagnosis of fracture of the nasal bones can be made by careful exami-

Tidrick, R. T., and Warner, E. D.: Fibrin ion of Skin Transplants, Surgery **15**:90 (Jan.)

(*a*) Bering, E. A., Jr.: Chemical, Clinical and nological Studies on the Products of Human a Fractionation: XXII. The Development of Foam as a Hemostatic Agent for Use in Con- on with Human Thrombin, J. Clin. Investigation 6, 1944. (*b*) Ingraham, F. D., and Bailey, O. T.: al Use of Products of Human Plasma Fractiona- J. A. M. A. **126**:680 (Nov. 11) 1944.

Young, F.: Skin Graft Fixation by Plasma- mbin Adhesions, Ann. Surg. **120**:450 (Oct.) 1944.

41. Salinger, S.: Traumatic Deformities of the Nasal Septum, Ann. Otol., Rhin. & Laryng. **53**:274 (June) 1944.

42. Gurdin, M. M.: The Early Care of Nasal Fractures, U. S. Nav. M. Bull. **41**:1706 (Nov.) 1943.

nation without the aid of a roentgenogram when the latter is not available. In reduction of the fracture, a careful examination is made after the patient is under anesthesia. If displacement of the septum has occurred, it is reduced by traction and manipulation with the Ash forceps. For comminuted fractures, a knife handle or a Kocher clamp is inserted into the nares for internal pressure, while the thumb and the index finger of the left hand are employed for external pressure and for molding the nose into proper shape. Packing is used to control bleeding and provide internal splinting in depressed or comminuted fractures. For external splinting a metal form covered with adhesive tape is bent to fit the nose.

Proetz [43] gives a concise account of the physiology of the nose and emphasizes important surgical considerations in regard to it. Schrapnel has no respect for cilia, and the surgeon will have little choice in selecting the avenue of approach for the removal of metallic foreign bodies. However, the replacement of parts which may have been disturbed but not destroyed should be accomplished with the least scarring. In instances of nasal operation affording any choice, scars may best be made in locations least exposed to air currents, so that any deficiency in epithelization may not be followed by drying and consequent failure of the cilia to regenerate.

In Gatewood's opinion,[44] obstructed breathing may be pronounced in the long convex nose with drooping tip and subluxation of the lower part of the septum. On patients who have marked drooping of the nasal tip with a short columella and without deviation of the nasal septum, a septal operation is not required. Lengthening the columella and lifting the tip will suffice to relieve the obstructed breathing.

The anatomy and the function of the muscles and cartilages of the nose are described by Griesman.[45] These tissues serve as supportive structures and as organs of movement.

The author believes that there is potential danger of injuring physiologically important muscles and fibrous membranes through endonasal plastic surgery. To avoid damage to the muscles of facial expression, the lines of incision and the planes of separation should follow the directions of the muscle fibers and of the ap rosis.

When the nasal tip is elevated by the septocolumellar suture, a widening or a w distortion often occurs at the septolabial Daley [46] advises the correction of this angle by means of the submerged perfo suture described by Aufricht. This suture the base of the columella backward again base of the septum, thus restoring a n septolabial angle.

Felderman [47] discusses the embryology the anatomy of the nasal structures and t of grafts of bone or cartilage to fill in defe the nose. Post-transplant occurrences have to be taken into consideration i extension of newly formed blood vessels t the graft, uninterrupted osteogenesis and n adaptation of the graft to its new bed. author warns that persons with neurotic dencies are preferably not accepted for trea as they make dissatisfied patients.

According to Berson,[48] the failures en tered in rhinoplastic procedures are due to lack of artistic sense than to lack of su skill. He points out in detail the proper es approach by giving ideal specific measure of the nose in relation to the rest of the fac a method of studying the facial planes by his rhinometer.

To complete narrowing of the dorsum an bridge of the nose, the lateral bones are through on each side. A chisel is then in in the web between the septum and the bone. With a few taps of the hammer and outward leverage of the chisel the nasal are separated from their frontal junction this method one may eliminate fractures thinner part of the bone usually caused by pressure of the hammer.

A systematic description of the technic typical rhinoplasty operation is given by Luo The nasal framework is uncovered throug cision between the upper and the lower l cartilages, and the bony hump is removed a saw. Procedures are described for app mating the upper lateral cartilages and mod the lower lateral cartilages. During the first eight hours the patient is kept flat on his with sand bags at each side of the head.

43. Proetz, A. W.: Physiology of the Nose from the Standpoint of the Plastic Surgeon, Arch. Otolaryng. **39**:514 (April) 1944.

44. Gatewood, W. L.: Correction of Multiple Deformities of the Nose, Virginia M. Monthly **71**:227 (May) 1944.

45. Griesman, B.: Muscles and Cartilages of the Nose from the Standpoint of a Typical Rhinoplasty, Arch. Otolaryng. **39**:334 (April) 1944.

46. Daley, J.: Retaining a Correct Septolabial in Rhinoplasty, Arch. Otolaryng. **39**:348 (April)

47. Felderman, L.: The Surgical Principl Rhinoplasty, Pennsylvania M. J. **47**:13 (Oct.) 194

48. Berson, M. I.: Important Considerations Rhinoplastic Procedures, Eye, Ear, Nose & T Monthly **22**:424 (Nov.) 1943.

49. Luongo, R. A.: Typical Rhinoplastic Oper Arch. Otolaryng. **40**:68 (July) 1944.

day after operation the nasal splints and cking inside the nasal cavities are removed. he experience of Lamont [50] many of the ts seen by the plastic surgeon present prob- of mechanical blockage caused by deflected ns, enlarged inferior turbinates, polyps or obstructions. In such patients submucous ion, cauterization of the inferior turbinates nvestigation of sensitivity factors are indi- to relieve the obstructed breathing and normal nasal function. Obstruction to ing may also occur in patients with long lateral cartilages and a dropped nasal tip. narrowing a large hump nose, the plastic on should remember that not only must the protruding portion of the upper lateral ges be removed, but also a wedge on each mesially, so that these tissues shall be in ortion to the newly created narrow bridge. addle nose depression either autogenous age or preserved cadaver cartilage may be d.

The influence of nasal deformity on nasal ion is discussed by Wolf.[51] He states that nal nasal deformity is closely interlaced with pathologic conditions. Both the confor- n of the external nose and the size and the on of the nostrils are essential determining s in modifying the air currents. Much of asal surgery, such as resection of a tur- or straightening out of a deviated septum end in therapeutic failure unless the func- of the external nose is taken into con- tion.

ment.—When patients complain of ob- ion to breathing through the nose, one always examine the position of the nasal d the width of the nasal orifices and colu-

Though the nasal orifices appear suf- ly wide during expiration, they may collapse ally toward the columella during inspiration. patient who has difficulty in drawing air gh the nose on inspiration is able to inspire ally when the nostrils are prevented from sing or when a wide columella is squeezed er with a forceps, or when the nasal tip ated, intranasal operation will not remove struction to his breathing. In such cases will be obtained by preventing collapse of ostril, by narrowing the columella or by ing the drooping nasal tip.

obtain esthetic results in rhinoplasty, Ber- has devised a sterilizable rhinometer. This is useful in the diagnosis of nasal deformities and is valuable in checking the required normal measurements during nasal operations. The instrument is described and illustrated.

Bolotow [53] discusses the surgical treatment of nasal obstruction. He concludes that a correct diagnosis of the pathologic factors causing improper distribution of air in the nose must be made before a submucous resection is attempted.

According to Ersner,[54] rhinologists have ignored the fact that when an external deformity exists in conjunction with a deviated septum, it is their responsibility to correct both. As a rule, they perform the submucous resection but hesitate to correct the external deformity. This has permitted the cosmetician to enter the profession and has allowed many quasirhinologists, who style themselves "plastic surgeons," to invade the specialty.

Ersner emphasizes that excessively long upper lateral cartilages may cause obstruction to breathing which will not be relieved by a submucous resection. At one time it was believed that a saddle nose which followed a submucous resection was due to the complete removal of the septum. The author is of the opinion that the saddle deformities are caused by shortness of the upper lateral cartilages rather than by the complete removal of the ventral end of the septal cartilage.

A procedure for the repair of a deflection of the nasal tip associated with a displacement of the lower border of the septal cartilage is described by Seltzer.[55] He frees the nasal structures from the septum along the dorsum of the nose and separates the lower free border of the septal cartilage from the columella with the button end knife. The septum is then displaced, and a segment of cartilage is removed on the convex side just anterior to the angle of deflection. This permits the displaced lower end of the septal cartilage to be brought back into a midline position. Care is taken to avoid injury of the perichondrium on the opposite side of the displaced segment of cartilage since this attachment is necessary for the life of the cartilage. The front border of the septal cartilage is then sutured to the columella with the nasal tip in a normal midline position.

amont, E. S.: Reconstructive Surgery of the n Congenital Deformity, Injury and Disease, Surg. **65**:17 (July) 1944.

Wolf, G. D.: Rhinoplasty and Its Relation to ogy, Am. J. Surg. **62**:216 (Dec.) 1943.

52. Berson, M. I.: A New Rhinometer, Am. J. Surg. **63**:148 (Jan.) 1944.

53. Bolotow, N. A.: Surgical Treatment of Nasal Obstruction, Arch. Otolaryng. **40**:198 (Sept.) 1944.

54. Ersner, M. S.: Reconstruction of the Deformed Nasal Septum, Arch. Otolaryng. **39**:476 (June) 1944.

55. Seltzer, A. P.: The Nasal Septum: Plastic Repair of the Deviated Septum Associated with a Deformed Tip, Arch. Otolaryng. **40**:433 (Dec.) 1944.

Comment.—The operation described by Seltzer is the conventional nasal plastic approach combined with a special procedure for the correction of the displaced lower border of the septal cartilage. The author is commended for his clear description of technic and for the excellent illustrations.

It may be good judgment to preserve an intact mucoperichondrium on one or both sides of the displaced segment of cartilage, but this attachment is not necessary for "the life of the cartilage."

The mucoperichondrium can be elevated on both sides of the displaced septal cartilage when this is necessary for the convenience of the operator. In such cases the septal cartilage be-

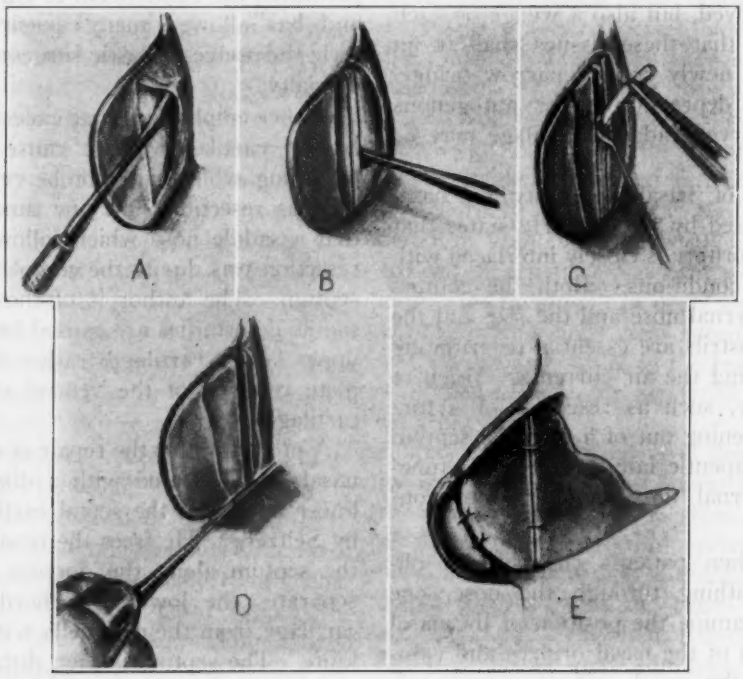


Fig. 4.—*A*, undermining the mucoperichondrium. *B*, cutting a narrow strip from the septum. *C*, remov strip of cartilage with a goose neck hook and forceps. *D*, showing the line of incision through the sept tilage along the nasal floor. *E*, showing the sutures in place holding the straightened septum in position. Seltzer.[55])

comes a free graft but it will survive, as will any autogenous septal cartilage graft.

In Barsky's opinion,[56] small losses of the alar rim can be repaired with a small flap of skin taken from the side of the columella. This method consists of forming a small skin flap not larger than a quarter of an inch in width and a half-inch in height at the side of the columella, with the pedicle toward the base of the columella. At the same operation a hinge flap consisting of the skin of the outer surface of the nostril is turned down to form a lining and the columellar flap is sutured over this hinge flap to pro covering for the defect. A small epidermic can be used to cover the donor area columellar flap.

After an interval of about two week pedicle of the columellar flap is severed a remnant returned to the donor area.

Maltz [57] reports the successful repair of a loss at the tip of the nose by means of a re tube pedicle formed on the dorsal surface hand. The hand is elevated and fixed by a p cast, and one end of the skin flap is sutured the defect at the nasal tip. The author stat the skin on the dorsal surface of the han

vides an excellent match with the nasal s respect to color and general texture.

Comment.—This is a rather complicate cedure to repair a small loss of the nasal t skin flap raised from the nasal-labial fold face is a simpler procedure and is attend much less discomfort on the part of the p

In a case reported by Jervey [58] there wa genital occlusion of both anterior nares. atretic structure was membranous, and

56. Barsky, A. J.: A New Method for the Repair of a Small Loss of the Alar Rim, Arch. Otolaryng. **39**: 325 (April) 1944.

57. Maltz, M.: Reconstruction of the Nas Am. J. Surg. **63**:203 (Feb.) 1944.

58. Jervey, J. W.: Congenital Occlusion o Anterior Nares, Ann. Otol., Rhin. & Laryng. (March) 1944.

r incised the web on each side and packed naris firmly with a fingercot filled with latum-treated gauze. This was left in situ ix days and then was replaced by a rubber A safety pin was passed through the pro- ng ends of the two tubes. At examination weeks after operation, both nasal passages normal in size and appearance.

HARELIP AND CLEFT PALATE

cording to Vaughan,[59] plastic repair of the and soft palates of an infant should not be dered before the eighteenth month. Better ts may be expected if repair is deferred until cond or the third year. The author prefers on Langenbeck type of operation, in which mucoperiosteum covering the hard palate is aced toward the midline and the approximat- dges sutured. This is followed by midline re of the areas of the soft palate. The soft te is encircled with a silver ribbon to relieve on on the suture line of the soft palate flaps.

ughan advises the Dorrance push-back ation for clefts involving only the soft palate there is need for additional length of the te. When the cleft extends through the hard te and the palate is short, he uses a special edure for lengthening the palate. Excellent wings accompany the article.

mmenting on cleft palate deformities Kem- states: Of all the facial anomalies, per- none has been given more thought and effort he surgeon with such discouraging results. elieves that good surgical repair of the cleft te is important but that there should also telligent coordination of other, related prob- These concern the cooperation of the family the program of the surgeon, the proper ng of the child and speech training. The on's responsibility does not end with the letion of the operation even though perfect omic reconstruction has been accomplished. when a perfect physiologic result is evident, normal speech, should he consider the case d. Occasionally normal speech is a natural ence of a successful surgical operation. Un- nately, this is not always true and a con- d program is required, embodying speech ing, dental and orthodontic treatment and care related to normal development and well-being of the child. The parents should made to see that the services of an expert in speech training are as important as those of the surgeon.

Comment.—Kemper presents important facts in the handling of children with cleft palate, facts which are known to surgeons in this field but which are not usually emphasized in their communications. The author is commended for his clear and honest discussion of the subject.

The management of harelip and cleft palate in babies is discussed by Schultz.[61] He prefers, whenever possible, to keep the deformed baby in the hospital until the lip is closed. Relatives and friends who wish to see the child are shown a normal baby with similar features to prevent gossip which would hurt the parents' feelings. The cleft lip is closed after three weeks if the child is in good condition and approval of the operation is given by the child specialist in charge of the feeding and the general care of the infant. The palate is closed when the child is 3 to 6 months old.

Davis and Selleck[62] stress the importance of restoring a normal appearance to patients with harelip and cleft palate. Adults who have poorly repaired lips and palates may suffer both socially and economically to the point of complete mental derangement. In afflicted children complexes develop because of the ridicule of their playmates, and they grow up into shy or repressed persons.

The authors feel that this type of deformity calls for vision and ingenuity on the part of the surgeon if a satisfactory result is to be obtained. Various types of poorly repaired harelips are presented with the operative technic used for successful repair.

Imperatori[63] reports the successful removal of an atretic structure from the pharynx by the Mackenty method. In this procedure two U-shaped flaps are formed on each side of the uvula and each of the flaps is separated from its fibrous connection with the posterior wall of the pharynx. The flaps are then turned forward on themselves and retained in position with sutures anchored by split shot.

An obturator (Latin, obturare, to stop up) is described by Beder[64] as a disk or a plate or a plug, natural or artificial, that closes an opening. From the dental standpoint it is a denture

59. Vaughan, H. S.: The Surgical Correction of Congenital Cleft Palate, S. Clin. North America **24:** (April) 1944.

60. Kemper, J. W.: Cleft Palate, J. Oral Surg. **2:** (July) 1944.

61. Schultz, L. W.: The Care of Cleft Lip and Palate in Babies, Illinois M. J. **86:**138 (Sept.) 1944.

62. Davis, A. D., and Selleck, G. A.: Restoration of Facial Contour in Surgery of the Secondary Cleft Lip and Palate, Am. J. Surg. **64:**104 (April) 1944.

63. Imperatori, C. J.: Atresia of the Pharynx Operated upon by the Mackenty Method, Ann. Otol., Rhin. & Laryng. **53:**329 (June) 1944.

64. Beder, O. E.: Obturators: A Review, J. Oral Surg. **2:**356 (Oct.) 1944.

that corrects an opening of the palate, soft, hard or both. After the obturator has been completed and inserted, the improvement in speech will vary in the different patients. It is essential to advise many of them to attend a speech clinic where their problems can be correctly analyzed by competent teachers.

SURGERY OF THE JAWS

In the experience of New and Erich [65] bone chips are satisfactory for the repair of small bony defects in the mandible. However, when there is a considerable loss of bone, they believe that a good functional result can be obtained only by the use of a single piece of bone to bridge across the defect.

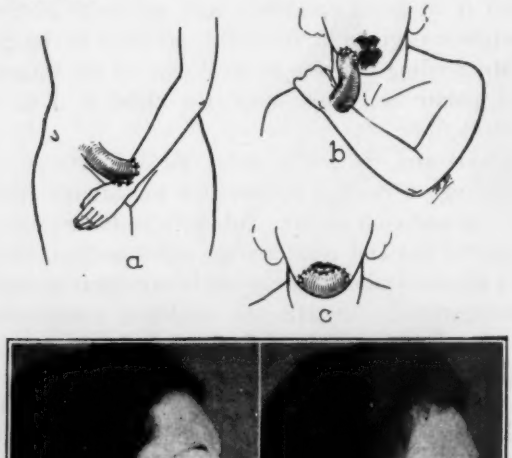


Fig. 5.—Loss of the soft tissues of the chin occurring in conjunction with a loss of bone in the anterior part of the mandible. In cases such as this, the soft tissues must be reconstructed several months before a bone graft can be applied. *a*, *b* and *c*, reconstruction of the soft tissues of the chin by means of an abdominal-wrist tube flap; *d*, preoperative view of the patient; *e*, postoperative view (the soft tissues of the chin have been reconstructed and a bone graft has been inserted). (After New and Erich.[65])

The authors prefer the crest of the ilium as a source of bone grafts. They report cases in which large grafts of ilium have been used to reconstruct the entire ascending ramus and a portion of the body of the mandible. Occasionally a defect of the mandible is associated with a loss of the overlying soft tissues. In such instances, before one can proceed with a bone graft it is necessa reconstruct the soft tissues, using some fo tubed skin graft containing fat.

Kazanjian [66] divides the treatment of gu wounds of the face and jaws into two di periods: first, the early period, which is cr for the patient's life, lasting from three to weeks following injury. This is the peri initial exhaustion, of loss of blood, of pronou sepsis and of pain and mental depression. is also the time at which alarming complica such as bronchopneumonia, secondary he rhage and general infection are most like occur.

The second period of treatment is con chiefly to further repair of the bony tissue means of splints, to the construction of pros appliances, to minor operations and to p operations for the reduction of the facia formity.

Parker [67] believes that the extraoral fix appliances have a definite place in the trea of fractured jaws. They should be used in in which they are indicated, and not as a routine technic in all cases, as has been advo by a few surgeons. These appliances are indi when there is an absence or an inadequate am of intraoral anchorage for the usual sy wiring or arches.

In Strock's opinion,[68] direct fixation i method of choice in cases of fractured ed lous mandibles in which displaced fragment present and accessible. Wiring of this type ates the necessity for skeletal fixation in instances of mandibular fracture without lo tissue. In view of the known toleration of va inert metals, it is advisable that wires ma these inert substances be used whenever fixation of the fractures is indicated.

In an interesting collective review Tho presents the development in the treatme maxillary fractures during the interval be World War I and World War II. This s includes the treatment of war wounds of the in general, a discussion of the types of bone used and a description of the methods emp in the treatment of fractures of the jaw.

65. New, G. B., and Erich, J. B.: Bone Grafts to the Mandible, Am. J. Surg. **63**:153 (Feb.) 1944.

66. Kazanjian, V. H.: Early Treatment of G Wounds of the Face and Jaws, Surgery **15**:22 1944.

67. Parker, D. B.: Skeletal Fixation in the ment of Fractures of the Mandible, S. Clin. America **24**:381 (April) 1944.

68. Strock, A. E.: Inert Metals in Direct Fi of Mandibular Fractures, Surg., Gynec. & Obst. (May) 1944.

69. Thoma, K. H.: The History and Treatm Jaw Fractures from World War I to World W Surg., Gynec. & Obst. **78**:281 (April) 1944.

Dingman [70] reports 6 cases of prognathism in which correction was carried out by section of the ramus and immobilization for a period of six weeks. Three of these patients had nonunion at the site of osteotomy which necessitated open reduction and direct wiring. These failures were apparently due to separation of the fragments, caused by medial and forward displacement of the upper fragment as a result of the action of the temporal and external pterygoid muscles. In the recent cases of prognathism the author has modified his technic to include direct wiring of the fragments at the time of the initial operation, with gratifying results.

According to Hill,[71] gravity drainage is the prevailing hazard in cases of antroalveolar fistula, and the main principle in management is control of the sinus infection. Early attention aimed at controlling intranasal drainage may result in spontaneous healing, or the fistula may heal in response to simple methods of closure. When the Caldwell-Luc operation is necessary it should be combined with plastic procedures designed to meet existing conditions. Secondary plastic operations may be required to close defects of the canine fossa in cases of extensive involvement of the antrum.

In a case described by Greeley and Throndson [72] an unusual complication resulted from the application of a Roger Anderson splint in the treatment of an oblique fracture through the right ramus of a mandible. At the time of application of the splint, one of the pins accidentally injured the underlying facial artery and vein. A swelling with pulsations developed immediately. Ten days later, following complete healing of the fracture, the mass was removed by resection between the ligated proximal and distal ends of the facial artery and vein.

Berger [73] concludes that many phases of osteomyelitis of the jaws have not yet been sufficiently studied from the points of view of physiology, bacteriology and pathology, to make possible a final expression of opinion. Arterial and venous thrombosis do not play the important role in the pathogenesis of the disease in the jaws which they are said to play in osteomyelitis of the long bones. The effectiveness of sulfanilamide and its derivatives and of penicillin will be decided only after a larger number of cases have been carefully studied and checked.

SURGERY OF THE FACE AND SKULL

The measures used for the replacement of large losses of tissue are discussed by Ivy.[74] Some bony defects accompanied by loss of soft tissue can be satisfactorily repaired with skin flaps alone when the loss of bone involves an immovable part such as the hard palate or the outer surface of the maxilla. Where a large bony defect is accompanied by loss of skin and mucous membrane, both epithelial surfaces should be replaced.

For the deeper and the more extensive contour defects of the frontal region, the nose, the cheek, the chin or other parts of the face, costal cartilage is the most satisfactory replacing substance. Ivy points out that costal cartilage is easily obtained in almost any desired quantity and that it can be readily trimmed to suitable size and shape. *While living autogenous costal cartilage is undoubtedly preferable to any other,* in recent years many operators have successfully used preserved cartilage from other persons and even from cadavers.

Peer [75] discusses the physiologic and clinical aspects of cartilage grafting and describes additional uses for "diced cartilage grafts." The following paragraphs are quoted from his conclusions:

1. The important consideration when transplanting fresh autogenous cartilage is survival of the living element of cartilage, the cartilage cell. The matrix of the cartilage graft will remain unchanged if the cells remain viable. If the cells die the matrix will ultimately be invaded and replaced by connective tissue.

3. Fresh autogenous cartilage grafts survive successful transplantation as living tissue whether transplanted with or without perichondrium. Adult grafts neither increase nor decrease in size. There is experimental evidence indicating that young autogenous cartilage grafts continue to grow following transplantation.

4. Living isogenous cartilage and preserved cadaver cartilage are inferior materials for grafting purposes. In selected cases preserved cadaver cartilage has an important field of usefulness.

5. A new technic for grafting by diced cartilage grafts is described.

6. It is possible to form a patient's own cartilage into any desired shape by packing diced cartilage segments within a perforated vitallium mold and burying the mold beneath the patient's skin.

The successful formation and transplantation of a cartilage auricular framework to replace an absent auricle are reported.

70. Dingman, R. O.: Osteotomy for the Correction of Mandibular Malrelation of Developmental Origin, Oral Surg. **2**:239 (July) 1944.

71. Hill, F. T.: Management of the Alveolar Fistula, Arch. Otolaryng. **40**:167 (Sept.) 1944.

72. Greeley, P. W., and Throndson, A. H.: Arteriovenous Aneurysm Resulting from Application of the Roger Anderson Splint, J. A. M. A. **124**:1128 (April 1944.

73. Berger, A.: Osteomyelitis of the Jaws, S. Clin. North America **24**:392 (April) 1944.

74. Ivy, R. H.: The Repair of Bony and Contour Deformities of the Face, Surgery **15**:56 (Jan.) 1944.

75. Peer, L. A.: Cartilage Grafting, S. Clin. North America **24**:404 (April) 1944.

Kazanjian and Holmes [76] review 38 cases of the past few years in which operation was performed for the correction of a cranial defect following a previous operation for osteomyelitis of the frontal bone. Bone, cartilage, vitallium, tantalum and an acrylic substance were used by the authors to replace the absent frontal bone. The living transplants should be employed when possible, as there is no perfect substitute for living tissues. Cartilage in large segments or as diced grafts may be employed for replacing small areas of lost bone or for improving the contour of the brow over a previous bone graft. Bone should be used to fill in defects up to 2½ inches (about 6 cm.) in diameter. In the larger areas the procedure is much easier and the cosmetic result on the whole is more satisfactory when one of the prepared plates is inserted.

A method of repairing cranial defects by means of cast bone chip grafts is described by Converse and his associates.[77] Bone is removed from the inner table of the ilium and sectioned into cube fragments measuring 0.25 to 1 cm. After these fragments are packed in a prepared metal mold, blood is mixed with them. The two sides of the mold are approximated, and pressure is applied and maintained until the blood has clotted. The cast of bone chips is then removed from the mold and put in position to fill the bone defect in the skull. The authors satisfactorily repaired defects in the skulls of 3 patients by this method.

Conley [78] reports a case in which an osteo the frontal bone was removed through a frontal flap exposing the dura. Bleeding controlled with a Bovie unit, and a previ prepared tantalum plate was inserted to fi bony defect. The edges of bone on which tantalum plate rested were lowered in orde obtain smooth approximation and the plate fastened to the bone with tantalum wire. scalp flap was then approximated without institution of drainage and a pressure ban applied. The wound healed by primary in tion, and the convalescence was uneventful.

For correction of the depression follo osteomyelitis of the frontal bone Brown [79] pr a vitallium skull plate. Cartilage from a cad may be used if the deformity is not too large if one piece of cartilage can suffice. The objection to this method is that the carti cannot grow to the surrounding bone and

Fig. 6.—*A*, marked depression of the left frontal region due to loss of bone. *B*, elimination of depre by implantation of costal cartilage. (After Ivy.[74])

to depend on its fibrous bed for its firmness fixation. A disadvantage of the bone gra the rather high incidence of infection at the si implantation, with loss of the bone graft i

According to New and Erich,[80] gratif results from reconstruction of lost portion the scalp can be obtained only by employme hair-bearing pedicle scalp flaps. An exte defect that is unilateral and located anteri can be repaired extremely well by means pedicle flap from the opposite side of the s

76. Kazanjian, V. H., and Holmes, E. M.: Reconstruction After Radical Operation for Osteomyelitis of the Frontal Bone, Surg., Gynec. & Obst. **79**:397 (Oct.) 1944.

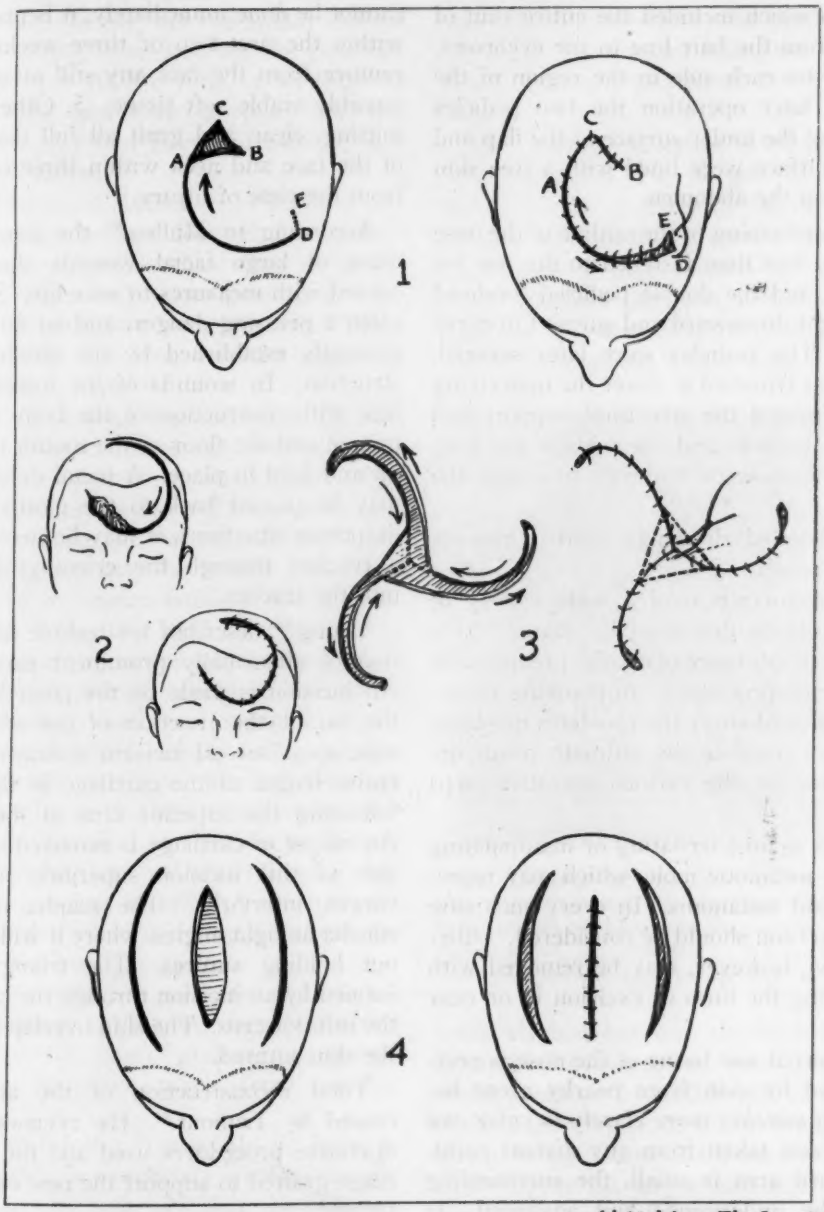
77. Converse, J. M.; Clarke, C. D., and Guidi, H.: Repair of Cranial Defects by Cast Chip-Bone Grafts, J. Lab. & Clin. Med. **29**:546 (May) 1944.

78. Conley, J. J.: Reconstruction of the Frontal with a Tantalum Implant, Following Removal Osteoma, Arch. Otolaryng. **40**:67 (July) 1944.

79. Brown, L. A.: Osteomyelitis of the Frontal Arch. Otolaryng. **39**:485 (June) 1944.

80. New, G. B., and Erich, J. B.: Hair-Be Scalp Flap for Repair of Unilateral Scalp De S. Clin. North America **24**:741 (Aug.) 1944.

this technic, not only is the involved surcovered with hair but, in addition, a normal line across the forehead may be established. n when the defect involves one entire side of scalp the application of a pedicle flap will e a remarkably good cosmetic effect. In latter type of case the same surgical pro-



Adapted from The Lancet

Fig. 7.—Various methods of closure of scalp and forehead defects by rotating and sliding skin flaps. (After Gillies.[81])

dure is to be recommended because it restores normal hair line across the forehead. The r when allowed to grow long can be arranged over the remaining bald surfaces completely. Gillies [81] recommends plastic procedures for closure of scalp wounds to avoid tension of the suture line, which might jeopardize primary healing and endanger the value of cranial surgical repair. A flap, or flaps, should be cut so that tension is dispersed from the point of danger and distributed over a wide area. This is achieved by the author in three ways: (1) by sliding rotation flaps, (2) by curved tripod flaps and (3) by relaxation incisions (see fig. 7). The first two methods, applicable to triangular wounds, are alike in principle, but the sliding

81. Gillies, H.: Plastic Closure of Scalp Wounds, Lancet 2:310 (Sept. 2) 1944.

rotation flap is the one of choice, as the line of suture is single and does not lie directly over the cranial defect. Relaxation incisions are useful in preventing tension in linear defects.

Barsky [82] reports the successful repair of extensive losses of the middle third of the face resulting from a gunshot wound. He made a latex rubber pattern of the defect and from this pattern outlined a flap which included the entire skin of the forehead from the hair line to the eyebrows, with a pedicle on each side in the region of the temple. At a later operation the two pedicles were tubed, and the under surface of the flap and the forehead surface were lined with a free skin graft taken from the abdomen.

A denture conforming to the outline of the nose and the cheeks was then fastened to the few remaining teeth, and the double pedicled forehead flap was brought downward and sutured to cover this denture. The pedicles were later severed, and the flap was trimmed to cover the underlying denture that formed the structural support and the outline of the nose and the sides of the face. Later adjustments were required to create the upper lip.

Excellent detailed drawings clearly indicate the ingenious repair.

The surgical correction of a wide variety of facial deformities is discussed by Davis.[83] He emphasizes the importance of careful preoperative planning for each procedure. In planning reconstruction one should study the problems involved, endeavoring to visualize the ultimate result desired and to outline the various operative steps accordingly.

Davis warns against irritating or manipulating the blue-black melanotic mole, which may represent a malignant melanoma. In every such case only a wide excision should be considered. Other pigmented nevi, however, may be removed with safety by placing the lines of excision in or near their margins.

Loss of external soft tissue of the nose is preferably repaired by skin from nearby areas because this skin *matches more closely in color and texture* than skin taken from any *distant point.* If the deformed area is small, the surrounding tissues may be undermined and advanced. If the loss of tissue is considered somewhat large, then immediate or delayed pedicle flaps from the nasal labial folds, which are mobile and have a splendid blood supply, are used.

82. Barsky, A. J.: Use of One Flap to Restore Extensive Losses of the Middle Third of the Face, Ann. Surg. **118**:988 (Dec.) 1943.

83. Davis, W. B.: Some Deformities of the Face and Their Correction, Surgery **15**:43 (Jan.) 1944.

Blair [84] summarizes the procedures for e treatment of facial injuries in the order of t importance: 1. Establish a free airway. 2. M no tight closure of wounds within the floo the mouth without ample provision for de dent drainage. 3. Restore to and fix in pr position as early as is practicable all displ fragments or masses of the facial bones. If cannot be done immediately, it is preferably d within the first two or three weeks. 4. Do remove from the face any still attached bon possibly viable soft tissue. 5. Other things p mitting, clean and graft all full thickness b of the face and neck within three or four we from the time of injury.

According to Mullen,[85] the immediate tr ment of large facial wounds should be c cerned with measures to save life. Suffocatio often a pressing danger, and an airway mus promptly established by the elimination of struction. In wounds of the lower part of face with destruction of the bony supports, tongue and the floor of the mouth must be li up and held in place. A metal or rubber air may be passed back to the glottis or, in m desperate situations, it may be necessary to p a trochar through the cricothyroid membr into the trachea.

Young [86] describes his technic for the cor tion of abnormally prominent ears as follo An incision is made on the posterior surfac the ear at the junction of the scapha and concha. A second incision is drawn through entire length of the cartilage in this same l following the superior crus at the pinnal e An ellipse of cartilage is removed to the scap side of this incision superiorly and from concha inferiorly. The scapha is set on concha at right angles, where it will remain w out holding sutures. The triangular fossa formed by an incision through the cartilage al the inferior crus. The skin overlap is excised the skin sutured.

Total reconstruction of the auricle is d cussed by Lamont.[87] He reviews the vari operative procedures used and the types of c tilage grafted to support the new ear.

84. Blair, V. P.: Treatment of Battle Casualties Street or Industrial Wounds of the Face, Surgery 16 (Jan.) 1944.

85. Mullen, T. F.: The Early Treatment of Wo of the Face, S. Clin. North America **23**:1458 (O 1943.

86. Young, F.: The Correction of Abnormally Pr nent Ears, Surg., Gynec. & Obst. **78**:541 (May) 1

87. Lamont, E. S.: Reconstructive Plastic Surg of the Absent Ear with Necrocartilage, Arch. S **48**:53 (Jan.) 1944.

amont reports a case in which he removed l cartilage from a cadaver and transplanted framework beneath the skin in the region of absent auricle. Wet cotton and marine ge were used to tuck the skin into the con- tions of the cartilage, so as to outline the cture of the new ear. A skin tube was later ed upward from the region of the clavicle to the helix of the ear, but the author did not an Esser outlay to reconstruct the posterior ct of the ear. At the time of writing the ver cartilage had been in place for one dred and twenty-four days and clinically ap- ed well preserved.

From experimental studies of cartilage grafts ed in human tissues for relatively short ods Lamont concludes that when cadaveric ogenous (isogenous) or autogenous cartilage mplanted in the human being, it probably acts a foreign body but that the host organism es no effort to expel it.

Comment.—This is an interesting article cov- g a number of controversial subjects. The auricle which was constructed is only rea- ably acceptable on the basis of the photograph. s is not a criticism of the author's skill since same statement may be made concerning rly all total reconstructions of the auricle. ery surgeon doing this kind of work is con- tly changing his operative technic in an effort create a more normal-appearing ear while loying a smaller number of operative steps. There is considerable doubt, however, that averic auricular cartilage, whether fresh or served, constitutes the best material for sup- t of the new auricle. At the time of writing transplanted cartilage had been observed only ing a period of four months. A much longer e is required to determine the fate and the ical value of a cartilage graft.

The available evidence indicates that living ogenous cartilage is the most durable grafting erial and that this type of graft is always more rable than cartilage taken from another son.

According to Greeley,[88] it would be futile to mpt to suture a completely avulsed auricle k into place. He suggests that the cartilage cture of the avulsed ear be transplanted be- th the abdominal skin to keep it viable for re use as the framework for the new auricle. dence points to the fact that since it is ogenous cartilage the structure will probably undergo absorption as happens in isografts. exact framework is now ready for the plastic surgeon whenever the opportunity arrives for the actual reconstruction of a new ear.

Hanrahan and Dandy[89] state that for many years the standard procedure for correcting facial paralysis had been a spinofacial or a hypoglosso-facial anastomosis. The results were good but far from perfect. The advent of facial strips slung from the temporal fascia to the lower and upper lips and to the lower eyelid produced results as good as, if not better than, the anastomosis of nerves but each procedure left much to be desired.

The authors advocate a combination of the two procedures, i. e., a spinofacial anastomosis and insertion of strips of fascia for support of the paralyzed face at the same operation.

A simple technic devised by Schuessler[90] for repair of facial paralysis with tantalum wire is regarded by him as effective. An incision is made above the zygoma, and a long curved 18 gage needle is inserted into the incision and passed downward between the skin and the mucosa, while procaine hydrochloride is injected ahead of the advancing point of the needle. The needle is then brought close to the surface on the far side of the upper lip, and a stab incision is made to expose the point of the needle. A tantalum foil clip is placed around a muscle bundle in the upper lip, and a tantalum wire is passed through holes in the clamp. The ends of this tantalum wire are then threaded through the bore of the long needle

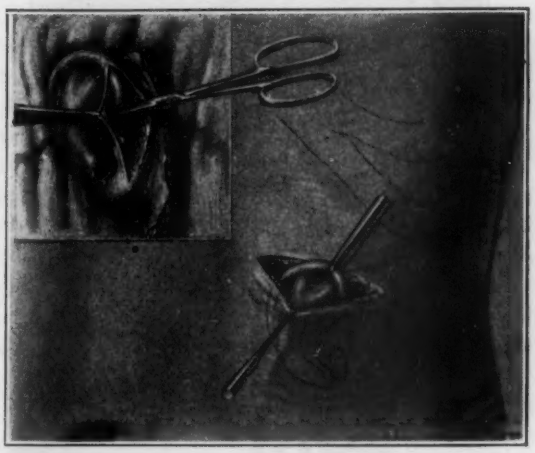


Fig. 8.—Inset drawing shows the cartilage framework being dissected from the overlying skin, the ear having been entirely avulsed from the patient's head. Below is demonstrated the insertion of the auricular framework in a subcutaneous abdominal pocket. (After Greeley.[88])

88. Greeley, P. W.: Reconstruction of the External Ear, U. S. Nav. M. Bull. **42**:1323 (June) 1944.

89. Hanrahan, E. M., and Dandy, W. E.: A Procedure to Correct Facial Paralysis, J. A. M. A. **124**: 1051 (April 8) 1944.

90. Schuessler, W. W.: A New Technique for Repair of Facial Paralysis, Surgery **15**:646 (April) 1944.

to the incision in the temporal region and the needle is removed. A tantalum clamp is placed about a small portion of the temporal muscle and fascia, and the tantalum wire that has passed through the incision into the temporal region is inserted into the small holes of this clamp.

The same procedure is carried out at the angle of the mouth and in the lower lip. The patient is then put in a sitting position and the wires tightened sufficiently to correct the paralyzed side of the face.

[NOTE.—A recent personal communication from Lieutenant Colonel Schuessler emphasizes

Fig. 9.—*A*, tantalum wires in position. *B*, drawing of wires with protective tantalum foil attached to temporal muscle and fascia. (After Schuessler.[90])

that the procedure as described is used more for temporary repair, to hold the muscles in balance while the nerve is regenerating. If it is used for permanent repair, the gage of wire should be larger.]

Coleman [91] discusses the surgical repair of the facial nerve following trauma in the facial canal and more peripherally in its distribution about the angle of the jaw and over the face. He po out the fact that, while this nerve regene rather well following surgical repair, the results from the standpoint of motor functio frequently disappointing. This results f mass movements returning to the facial mus rather than to individual muscles of expres Direct suture of the nerve or even engrafting small sections of nerve is to be preferred to form of anastomosis with another nerve, because better functional results can be obta but because the sacrifice of function by sect ing a normal nerve is not required.

In Lamont's opinion,[92] the method empl for the repair of facial paralysis should be de mined by an evaluation of the particular c If necessity should demand, nerve grafting reconstruction should be used in combinatio if nerve grafting is impossible, transplantatio fascia or of muscle and excision of the ex skin may be employed singly or in combinati

Owens [93] describes a new technic for com reconstruction of the lower lip. The repai accomplished by a combination of advance flaps of both skin and mucous membrane. results from this operation, as shown by ph graphs in the article, are excellent. Diagramm drawings clearly illustrate the procedure.

An excellent article on reconstruction of or all of the lips is contributed by May.[94] He vises the Estlander operation for closure of l defects not larger than half the width of the For closure of large horizontal defects of th (excluding the chin) the methods of Ferris Sm Pierce, O'Connor or Owens are recommen These procedures make use of flaps from the mediate neighborhood consisting of skin and s cutaneous tissue only. For closure of defect the lower lip and chin not larger than three q ters of the width of the lip the operatio Burow or that of Bernard is considered ad able. The operation of Dieffenbach with cer modifications in technic suggested by the au is approved for closure of defects of the en lower lip and chin.

Ford [95] presents a modification of the I rance operation for congenital shortening of

91. Coleman, C. C.: Surgical Lesions of the Facial Nerve, Ann. Surg. **119**:641 (May) 1944.

92 Lamont, E. S.: Plastic Surgery in Facial P ysis, Arch. Otolaryng. **39**:155 (Feb.) 1944.

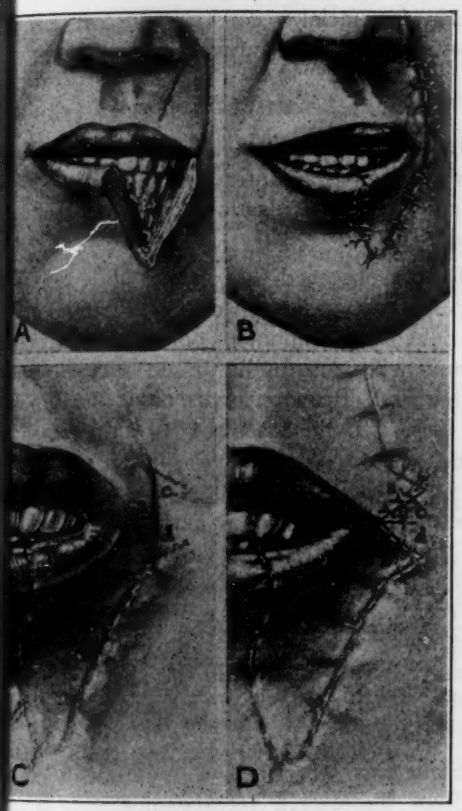
93. Owens, N.: Simplified Method of Rotating and Mucous Membrane Flaps for Complete Recons tion of the Lower Lip, Surgery **15**:196 (Jan.) 194

94. May, H.: Closure of Defects of the Lips Composite Vermillion Border-Lined Flaps, Ann. S **120**:214 (Aug.) 1944.

95. Ford, J. F.: A Plastic Operation for Leng ing the Congenitally Short Upper Lip, J. Oral S **2**:260 (July) 1944.

r lip. He severs the depressor septi, nasalis, vus superioris and nasolabialis muscles in ion to the three heads of the quadratus labii ioris muscle. The results of these operahave been uniformly satisfactory in that a in degree of lengthening of the lip was obd in each case.

here is no excuse for plastic surgical repair t the eye unless function and appearance are red, in the opinion of Pierce.[96] First in



g. 10.—*A*, triangular defect of the lower lip not r than one-half the width of the lip. The defect des the lower border of the left corner of the n. To close the defect, a vermilion border-lined is to be rotated from the upper lip and the naso- region. The pedicle of the flap containing the ary artery is to replace the corner of the mouth. flap should be made one-half as wide as the defect der to shorten the upper and the lower lip proonately.

flap rotated into the defect. The secondary defect sed by suturing the wound edges together.

reconstruction of a corner of the mouth in a case hich the pedicle of the flap (see *A* and *B*) forms ew corner of the mouth. The vertical shortness ercome by switching triangular flaps. Flap *a* is anged with flap *c*; flap *b* with flap *d*. Thus not the oral orifice is widened, but a more natural r of the mouth is achieved. (After May.[94])

Pierce, G. W.: Some Useful Plastic Procedures phthalmology, Tr. Am. Acad. Ophth. (1943) **48:** May-June) 1944.

planning comes the correct estimation of the defect to be filled. Scar tissue contracts, and often when an apparently small scar is completely excised, an appalling defect results, for which a previously cut skin flap will be quite inadequate. Only experience arms the surgeon against this too common mistake.

Cordes and Fritschi[97] report the results of 30 operations for ptosis of the eyelid in which the Dickey procedure was used. In this operation a sling of fascia lata is inserted through the middle third of the superior rectus muscle and fastened to the tarsus. The Dickey operation is indicated when the levator muscle is completely paralyzed and a normal active superior rectus muscle is present. In addition to its use in the presence of a normally functioning superior rectus muscle, the operation can be used to advantage on the patient who has slight weakness of the superior rectus muscle and whose eye is amblyopic or suppressed.

Various deformities in which there is a vertical deficiency of tissue of the eyelids are discussed by Kirby.[98] The principles of the repair consist of the removal of all constricting scar tissue and the transfer of conjunctiva or skin according to the requirements in the particular case. For cicatricial ectropin of the upper or the lower eyelid a full thickness skin graft removed from a normal upper eyelid is always desirable. When such skin is not available, a graft from behind the auricle will provide a covering of good appearance. When the patient has an extensive facial burn involving the skin of both upper eyelids and of the ears, an epidermic graft from the thigh may be used. Fortunately, in cases of severe burn the epidermis graft forms a fair match with the surrounding scarred skin of the face. Skin should never be taken from a lower eyelid to use on an upper one, since this will cause an ectropion of the lower lid.

Siegel[99] stresses the importance of immediate transplantation of buccal mucous membrane in the treatment of conjunctival and corneoconjunctival burns. Prompt grafting stimulates vascularization (which in turn provides the cornea with nourishment) and prevents formation of

97. Cordes, F. C., and Fritschi, U.: The Dickey Operation for Ptosis, Tr. Am. Acad. Ophth. (1943) **48**:266 (March-April) 1944.

98. Kirby, D. B.: Vertical Shortening Deformities of the Eyelids: Plastic and Reconstructive Surgical Correction, S. Clin. North America **24**:348 (April) 1944.

99. Siegel, R.: Buccal Mucous-Membrane Grafts in Treatment of Burns of the Eye, Arch. Ophth. **32**:104 (Aug.) 1944.

scar tissue with resultant symblepharon. With the exception of cases in which the entire perilimbal circulation is totally destroyed, grafting of mucous membrane shortens the healing process and offers a better prognosis.

According to Sugar,[100] the Hughes operation has been the most frequently employed procedure for the repair of defects involving the entire lower lid. In partial defects involving both cutaneous and conjunctival surfaces some of the other lid-splitting methods may be more advantageous. These methods are described and illustrated in the article.

Knapp [101] holds that a deep tear in the lower lid at the medial canthus calls for reattachment of the tissue to the periosteum posterior to the point of separation. In other lacerations of the lid margin, correct early suturing generally will prevent notching. Following fracture of the orbit with downward displacement of the fragments, there may be a depression within the orbital area. To remedy this, fascia lata serves well as a filling substance.

A case of downward displacement of the bony orbital floor into the antrum is reported by Johnson.[102] He used the Caldwell-Luc approach, removed necrotic masses of clotted blood and the lining membrane from the antrum and made an antral window into the inferior meatus for drainage. The depressed bony floor of the orbit was then elevated into position and a rubber balloon inserted in the antrum with its neck, in the form of a rubber catheter, protruding through the window opening into the nasal cavity and out through the nostril. The balloon was then inflated with about 10 cc. of water but roentgenographic study did not show the depressed bony floor of the orbit in normal position. On the following day an additional 10 cc. of water was forced into the balloon, which caused the depressed orbital rim to be elevated into a normal position. After three weeks the water was removed, and the balloon withdrawn from the antrum. The patient obtained a satisfactory result by this method of reduction.

According to Gerrie,[103] the newer plastics, which are polymerized resins, are superior to vulcanite for obturators and intraoral re tions. The plastics are light, translucent and tolerated, but they are not satisfactory as features. The author prefers latex rubbe prosthetic facial reconstruction. This ma has a remarkable skinlike texture and c given a normal cutaneous coloring. The d vantages of latex are its tendency toward sh age and discoloration of the pigments with Considerable research has been done with substances, and it is probable that improved terials for facial reconstruction will be f coming in the near future.

MISCELLANEA

In a panel discussion [104] on plastic sur Kirkham gave an interesting description o management of a plastic service in a large m hospital.

Brown observed that sulfonamide compo are effective in facial wounds if not used in cess. A large amount of one of these drugs wound will cause undue tissue reaction and be harmful. Brown also discussed the import of facial wounds resulting from explosion which gross particles of foreign material driven into the tissues. This results in b black tattooing, which is extremely objection on the face. Large particles should be taken soon after the injury, but it is often not pos to remove the numerous small particles. T conditions after they heal are a problem and quently require excision of the tattooed and replacement by free skin grafts or neigh ing skin flaps.

Straatsma described a method of injec sodium fluorescein intravenously to deter the blood supply of a skin tube or flap. He reported good results from exposure of l areas of indolent granulation tissue to ultrav rays and the reduction of large keloid scar injections of testosterone. Testosterone has been used for females with keloid scars.

Ivy [105] points out the importance of remo all particles of dirt before suturing wounds the face. This will obviate ugly discolored s when the wounds have healed. In closure wounds about the face reliance for coapta should be chiefly on buried subcutaneous sut of fine catgut, and the edges of the skin sh then be brought together evenly with very

100. Sugar, S. H.: Tarsoconjunctival Sliding—Graft Techniques for Eyelid Reconstruction, Am. J. Ophth. **27**:109 (Feb.) 1944.

101. Knapp, A. A.: Eye Injuries, U. S. Nav. M. Bull. **42**:651 (March) 1944.

102. Johnson, M. R.: Depressed Fracture of the Orbital Rim, S. Clin. North America **24**:340 (April) 1944.

103. Gerrie, J.: Prosthetic Face Reconstruction, Canad. M. A. J. **50**:104 (Feb.) 1944.

104. Ivy, R. H., and others: Plastic and Re structive Surgery, Clinics **2**:1165 (Feb.) 1944.

105. Ivy, R. H.: Plastic Surgery in Combat Civilian Casualties, M. Ann. District of Columbia 45 (Feb.) 1944.

es of horse hair or silk, the tension having been released by the subcutaneous sutures.

e author believes that the local application lfanilamide or sulfathiazole in potentially ted wounds is of distinct benefit in combat- nfection. In his opinion, costal cartilage is ost suitable of all substances to build out n contour due to defects in the supporting tures of the face. Living autogenous carti- s preferable for this purpose, but preserved age may also be used.

According to Munn,[106] it has been conclusively ed that homocartilage, properly preserved, e ideal medium for restoration of certain defects. In support of this statement he s the clinical experience of Straith and hter and the experimental work of Peer.

TE.—The experimental work of the reviewer ed by Munn showed that autogenous carti- e grafts buried in human beings were not ject to invasion or absorption. Preserved daveric cartilage grafts buried in human sub- ts were invaded and partly absorbed. This idence tends to contradict Munn's statement at preserved cartilage obtained from cadavers the ideal medium for restoration of facial fects.]

unn has established cartilage banks in which ollowing plan is carried out: The cadaver young adult male who has been accidentally d within the past few hours is selected. This ver must be free from syphilis and tubercu- , but blood typing is not necessary. As soon ossible after death the rib cartilages on both of the chest are removed, aseptic precau- being taken as in any other surgical pro- re. All perichondrium having been removed the cartilage, the latter is placed in a mix- consisting of 1 part of a 1:1,000 aqueous ion of merthiolate and 4 parts of isotonic ion of sodium chloride. The jar is stored in refrigerator and the solution changed every weeks, at which time cultures are taken.

irkham and his associates[107] contribute an inating article on the function and the nization of a plastic surgery department in ge naval hospital. They are convinced that a procedure such as skin grafting and the ciple of the Z plastic method should be under- n by surgeons giving immediate care to casualty patients. Cases requiring more than these two procedures should be handled at a base where definitive plastic surgery can be performed. The authors are opposed to the system of giving short courses to a large number of doctors and later permitting them to do the more complicated types of plastic operations. These should be undertaken only by surgeons with a long training in plastic surgery.

A contracture is defined by Greeley[108] as a pathologic shortening that results from the tension of a scar which is secondary to a cutaneous loss.

Scar contractures can be relieved by first excising all shortened fibrotic tissue, following which the parts are extended into a normal anatomic position. The resulting cutaneous defects are then closed by a Z plastic procedure or the use of a properly selected type of skin graft.

Scar contractures may be prevented by early covering of granulating defects resulting from burns or avulsions of skin, with skin.

All contractures in growing children should be corrected before permanent underlying bony maldevelopments occur.

A plea is made by Holman[109] for adherence to the old axiom that incisions in the neck should not cross the normal creases of the skin. An incision that crosses these in a region characterized by constant motion, as the neck, will almost invariably produce a thick unsightly scar that is likely to become more prominent as time passes. The ligation of the common or the internal carotid artery can be performed readily through incisions following creases of the skin in place of incisions paralleling the sternomastoid muscle. In the removal of a congenital sinus in the neck above the clavicle that extends upward to penetrate the pharynx, adequate exposure is easily obtained through two transverse incisions paralleling the creases of the skin. A temporary tracheotomy can also be performed through a transverse incision with minimum scarring, whereas, the scar of the vertical incision may forever be an aggravation to the patient.

In a plea for a campaign to reduce the hazards of burns Owens[110] states that all burns are accidental so far as the patient is concerned and that for this reason they lend themselves to a reduction in incidence provided certain types of

6. Munn, L. L.: Cartilage Banks, Bull. U. S. Army Dept., March 1944, no. 74, p. 99.

7. Kirkham, H. L. D.; Mills, J. T., and Potter, .: Plastic Surgery as Related to War Surgery, lin. North America **23**:1603 (Dec.) 1943.

108. Greeley, P. W.: The Plastic Repair of Scar Contractures, Surgery **15**:224 (Feb.) 1944.

109. Holman, E.: The Placement of Incisions in the Neck, Surg., Gynec. & Obst. **78**:533 (May) 1944.

110. Owens, N.: A Plea for a Campaign to Reduce Burn Hazards, Surgery **15**:207 (Jan.) 1944.

hazard are removed. The importance of such a program becomes apparent when one realizes that approximately 8,000 lives in the United States are lost annually as the result of burns. Burns now occupy third place as a causative factor in the production of accidental deaths in this country, being surpassed only by automobile accidents and falls.

Owens believes that the number of burns in children can be greatly reduced by proper supervision and training, by the avoidance of flimsy garments, which are highly inflammable, and by prohibiting the sale of fireworks and inflammable chemicals. Boiling water in open tubs is a frequent home hazard for small children.

Gillies [111] points out that the effect of good suturing of a wound or an incision goes much further than the production of a good-looking scar. It is one of the important factors in preventing infection from without; it diminishes the tendency toward hypertrophic thickening of the scar and toward the formation of a disfiguring and painful keloid.

How tight to tie sutures is a matter of experience. The correct degree lies between a tautness that is adequate to leave the edges closely apposed and that which cuts through by causing necrosis of tissue. Stitch marks are indisputable evidence of a stitch that has caused local necrosis of tissue and its accompanying infection. Err on the loose side.

Swan and co-workers [112] report on recent observations that maternal rubella (German measles) in the early months of pregnancy may be followed by congenital defects (cataract, heart disease, deaf-mutism, microcephaly and glomerular sclerosis) in the infants born subsequently. The authors noted that of 12 mothers who suffered from rubella during pregnancy 10 delivered infants with congenital defects. The abnormalities included cataract, deaf-mutism, heart disease, microcephaly and obliteration of the bile ducts. All except 3 of the 10 mothers with congenitally defective children had contracted rubella within the first three months of pregnancy.

Treatment may be more accurately chosen, the period of disability reduced and good results assured by prompt distinction between second and third degree burns shortly after injury. A simple, safe and accurate method for estimating the degree of impairment of the circulation in the burned area is described by Dingwall.[113]

The test is performed by slowly injecting 5 to 10 cc. of sodium fluorescein intravenously and carefully observing the burned area under ultraviolet rays screened with a Wood filter. Normal skin is yellow-green; second degree burns are the same color but of greater intensity than the normal skin, and third degree burns show up as sharply demarcated blue-black areas in the yellow-green skin. Transient nausea occurs if the injections were made too fast.

Webster, Stevenson and Stout [114] review a series of 162 cases of malignant melanoma of the skin. The ages of the patients ranged from 16 to 82 years. They conclude:

1. The diagnosis of malignant melanoma is often difficult and requires expert opinion.

2. A large percentage of malignant lesions arise from moles that have been stimulated by the patient or by a physician.

3. Complete eradication of all suspicious looking lesions and malignant melanomas should be carried out.

4. Irradiation is usually ineffectual.

5. Radical surgery is preferable to cauterization.

6. Depending upon the history and histologic examination of the lesion, radical regional lymph-node dissection should be performed.

7. The surgeon performing the operation should have a knowledge of the procedures of plastic surgery.

8. In the excision of malignant melanomas it should be emphasized that a *thoroughness of the procedure* is the first aim of the surgeon, that inadequate removal of the lesion endangers the life of the patient, and that the appearance and function of the part are of secondary importance. One cannot afford to compromise with the disease.

The interesting case of a man who excised his own larynx in an attempt to avoid military service is reported by Schuessler.[115] The author removed clots over the tracheal opening which were causing cyanosis. He found that the patient had removed the hyoid bone, the larynx, the thyroid gland, the trachea and part of the esophagus. The esophagus was later repaired by turning in flaps for the lining and using a long sliding flap for the covering.

111. Gillies, H.: Technique of Good Suturing, Clin. J., London **72**:223 (Nov.-Dec.) 1943.

112. Swan, C.; Tostevin, A. L.; Mayo, H., and Black, G. H. B.: Further Observations on Congenital Defects in Infants Following Infectious Diseases During Pregnancy, M. J. Australia **1**:409 (May 6) 1944.

113. Dingwall, J. A., III: A Clinical Test for Differentiating Second from Third Degree Burns, Ann. Surg. **118**:427 (Sept.) 1943.

114. Webster, J. P.; Stevenson, T. W., and Stout, A. P.: The Surgical Treatment of Malignant Melanomas of the Skin, S. Clin. North America **24**:[illegible] (April) 1944.

115. Schuessler, W. W.: Self-Inflicted Excision of Larynx and Thyroid and Division of Trachea and Esophagus, with Recovery, J. A. M. A. **125**:551 (June 24) 1944.

Moore [116] reports the successful treatment of patient for subglottic laryngeal stenosis by sion of the scar tissue and skin grafting. s technic eliminates repeated manipulation shortens the period of treatment.

n the opinion of Barsky,[117] not enough at- ion has been paid by the surgeon to the chology of the patient seeking improvement n plastic surgery. The child patient presents pecial problem that requires study and care. must be remembered that in the adult the disfigurement bears no inevitable proportional relationship to the mental distress it may engender.

Foman [118] believes that there is no unanimity of opinion in regard to the rightful place of plastic surgery as a branch of the surgical tree. The controversy lies between one school of thought, which believes that everything pertaining to the transplantation of tissue and reconstruction should come under the domain of the general plastic surgeon, and a second school, which advocates that plastic surgery be divided among the specialties in the various fields. The latter view is based on the supposition that no surgeon, however brilliant and skilful, can be equally proficient in all plastic procedures.

16. Moore, P. M.: Chronic Laryngeal Stenosis: ort of a Case Treated by Skin Grafting, Cleveland . Quart. **11**:5 (Jan.) 1944.

17. Barsky, A. J.: Psychology of the Patient Under- g Plastic Surgery, Am. J. Surg. **65**:238 (Aug.) .

118. Foman, S.: Role of Plastic Surgery in the Field of Otolaryngology, Arch. Otolaryng. **39**:518 (June) 1944.

Abstracts from Current Literature

Ear

TINNITUS AURIUM: OBSERVATIONS ON ITS NATURE AND CONTROL. MILES ATKINSON, Ann. Otol., Rhin. & Laryng. **53**:742 (Dec.) 1944.

Atkinson suggests that the question as to the nature and the causation of tinnitus has not been answered owing to the fact that it has been studied too exclusively from the otologic angle, to the neglect of the more general neurologic aspect of the problem. He points out that the auditory tract is phylogentically a peripheral sensory tract modified to subserve the functions of a special sense and that it obeys the same general physiologic rules as a peripheral nerve of common sensation, subject to the same or equivalent disturbances of function and for the same reason. When the auditory tract is regarded in this light, the symptom of tinnitus becomes the homologue of paresthesia in the peripheral sensory apparatus and can be produced by exactly the same stimuli. All the factors recognized by otologists as causes of tinnitus and impaired hearing are also recognized by neurologists as causes of paresthesia and peripheral neuritis. Both groups also recognize spontaneous or cryptogenic tinnitus, the cause of which has still to be found. The author discusses cases of this type.

Tinnitus could equally well be called auditory paresthesia, and the term would be more accurate. If this view is accepted, then tinnitus is symptomatic of an active pathologic condition in the auditory tract, which at least in the beginning is in the infrasegmental division. If sustained, it is a warning of impending deafness. Tinnitus is the homologue of paresthesia, impaired hearing the homologue of hypesthesia, and total deafness the homologue of anesthesia. Cochlear degeneration, when it occurs, is secondary to neuron degeneration.

In view of the similarity of tinnitus and impairment of hearing to peripheral neuritis, and in view of the thought that spontaneous sensory disturbances are the result of vasospasm, at least in part, the author conducted experiments on 175 patients who had persistent or troublesome tinnitus for months or years and who gave a normal response to histamine, adjudging them to have a primary vasoconstrictor mechanism. Stellate ganglion block improved the condition of 10 of 18. Single injections of acetylcholine chloride improved 8 of 14, sodium nitrite 3 of 5, strontium chloride 3 of 9; neostigmine methylsulfate and magnesium sulfate improved none. (The effects of prolonged administration will be reported later.) Vasodilators, ephedrine and amphetamine made all worse, although there was no change with epinephrine.

Nicotinic acid—not the amide—over longer periods gave definite and complete relief in 15 per cent and improvement in 48 per cent. Eighty-five per cent of the patients with conductive deafness were relieved or improved and 69 per cent of those with deafness of the perceptive type.

M. V. MILLER, Philadelphia.

REHABILITATION OF THE CHILD WHO IS HANDICAPPED BY DEAFNESS. RUTH P. GUILDER and LEROY A. SCHALL, Laryngoscope **54**:511 (Oct.) 1944.

As a result of the development of the vacuum tube hearing aids there are now greater opportunities to rehabilitate permanently deafened children. These children should be studied carefully. Their general h should be improved when possible. Criteria shou established for the recommendation of hearing Clinics should be established to aid in the initial a ment which the child will have to make. Afte child has become used to his better hearing wit aid, his educational program should be worked ou

The authors describe the work being done a Massachusetts Eye and Ear Infirmary, where "a dividualized remedial program has been outlined for child." They discuss the selection of the hearing and the use of the aids in different kinds of deaf Results are evaluated.

HITSCHLER, Philadelph

CERTAIN FUNDAMENTAL PRINCIPLES IN PRESCRI AND FITTING HEARING AIDS. L. A. WATSON, L goscope **54**:531 (Oct.) 1944.

Watson presents an excellent and comprehe article on the prescribing and fitting of hearing aid

One must use the audiometer, preferably augm by tests for hearing and intelligibility of speech w controlled microphone speech circuit or phonograp producer. Uncontrolled speech tests are of little v

Fatigue and the effort put forth in order to hea factors of importance. With these consideration mind tests may require many hours. Hearing aids give comparable results in the beginning may give v different results after prolonged testing, owing t energy expended by, or the fatigue induced in, the pa

The minimum loss of hearing for which a he aid will offer help, if figured by the American Me Association's table for evaluating percentage he loss, is 25 per cent; if figured from the decibel present in the "critical area" (1024 to 2896 deci it is 30 to 40 decibels.

What is the maximum loss with which one can e benefit from a hearing aid? Some persons with a as high as 90 to 95 decibels in the critical area helped. Most of those with a loss of 100 decibel more get no help. Those with unusual curves of h ing, such as the U curve, or one with no hearing frequencies above 1024 cycles per second, are some not benefited.

Not always should the better ear be fitted wit aid. Rules are given to assist in determining w ear should be fitted with an aid.

Bone conduction aids are usually not as benefici are air conduction aids. The former amplify the us already well heard low tones while neglecting the tones. There are exceptions, however.

Measurements of hearing with thresholds abov normal level, including the range of comfortable l ness and recruitment, are valuable in determining type of the hearing aid and the fitting. Procedure making such measurements with the microphone s circuit are explained.

Many makes of hearing aids are adjustable as to output; i. e., certain tones can be subdued or ampli Several methods of doing this are evaluated. Diff audiometric curves require different tonal amplificat to suit individual needs.

The role of the otologist in the fitting of a he aid is an important one, and it is too often negle Likewise, the otologist should supervise the maki

oes not actually make, the ear insert. After the nt has obtained the aid, the otologist should super- the patient's progress, which includes checking the ual hearing, seeing that the aid is used, correcting ts of speech and particularly assisting in the psy- gic rehabilitation of the patient.

HITSCHLER, Philadelphia.

OMPARATIVE STUDY OF WHISPER TESTS AND AUDIO- RAMS. JOSEPH L. GOLDMAN, Laryngoscope **54**:559 Oct.) 1944.

oldman presents data on 167 men with impaired ing who were tested both with the air conduction tone audiometer and with whisper, and, in some , with low conversation. He found that there was a great variation in the results of the two methods sting. The audiometric test is best for determining type of hearing, for obtaining a permanent record for obtaining other data, but the whisper, and in cases the low conversational test, seems to evaluate the actual loss of hearing. He feels that testing a phonograph or a microphone over a controlled ifying system would be still better. He uses the per and low conversational tests in his work in the ed States Army to determine the hearing fitness of ubjects.

HITSCHLER, Philadelphia.

IC MENINGITIS DUE TO BACILLUS PROTEUS, JUGU- AR SINUS THROMBOSIS, SEPTICEMIA DUE TO STREP- OCOCCUS VIRIDANS, THORACIC AND CARDIAC COM- LICATIONS, RECOVERY. E. LEE MYERS, Laryngoscope 4:619 (Nov.) 1944.

yers reports a case of meningitis with complications d by Bacillus proteus. Only a few such cases are ecord, but a sufficient number to place B. proteus e potentially pathogenic class. The case, with its lications and ultimate recovery, is described in l.

HITSCHLER, Philadelphia.

ING THE AUDITORY ACUITY IN SOLDIERS AND SSESSING THE OVERALL CAPACITY FOR HEARING OF PEECH. J. HARDIE NEIL, New Zealand M. J. **42**: 8 (Oct.) 1943.

described in the introduction of this paper, otolo- in the Army and the Navy are all familiar with ituation in which some director general of a de- ment calls for accurate measurement of some anical or physical situation. Mr. Neil responds to such a demand by the Director General of cal Services of New Zealand "calling for audiom- measurements of the acuity of hearing of soldiers hearing disabilities. . . ."

e stipulation is essentially indefinite but must be med to require an appraisal of disability due to earing loss. This conjecture is substantiated by ight pages of the author's paper.

. Neil reviews in considerable detail certain well n principles of audiometric technic and the effect rious types of hearing loss on the individual patient itical situations, either civilian or military.

discusses war injuries to the ear and their treat- suggesting gentle inflation of the eustachian tubes month or so after traumatic rupture of the drum. reviewer would defer this procedure indefinitely. says, "Otosclerosis or progressive deafness is tely the main problem in returned service per- l. Attributability of otosclerosis aggravation to damage has not been proved. Otosclerotic foci have been discovered in the five month embryo." This particular passage, of no possible significance in the author's general thesis, is quoted more or less purposely to exemplify the completely random concept of the vaguely established clinical entity "otosclerosis." The author persists in his discussion of "otosclerosis cases." No authority will present itself for any clinical assumption of this war casualty entity until it is recognized by ample autopsy material. This may of course develop, but it is extremely unlikely.

Though somewhat confused as to the order of presentation, the author's obvious obligation to the "issued instructions" is to appraise various hearing losses in relation to the associated physical disability. He discusses at some length the well known effects of acoustic trauma of every degree of severity. He then quotes Fowler and others with slight reference and at considerable length in regard to audiometric technics and the appraisal of hearing loss. The tables and the charts published by the Council on Physical Therapy of the American Medical Association are included, but it must be remembered that they are still subject to revision.

In the section of this paper entitled "Table Showing the Disability and the Pension According to the Schedule Scale Compared with the Overall Loss," the reviewer can have no possible opinion except that the author's suggested scale represents no significant benefit to any one except the pensioning parties. Up to the present time there has been no actual appraisal of disability resulting from a hearing loss and no interpretation of such a loss by any court of law so far as the reviewer knows. The United States Veterans Bureau has attempted to establish some such standard, but up to the present time the ratio of the inequities of induction into the armed forces so far as hearing is concerned are undoubtedly present in equal numbers in discharged service personnel.

Dr. Neil's paper is provocative in that the New Zealand authorities are taking steps to deal with an important and difficult situation. The report of the application of his recommendation will be awaited with interest.

HUGHSON, Abington, Pa.

Nose

THE USE AND ABUSE OF NASAL VASOCONSTRICTOR MEDICATIONS. B. M. KULLY, J. A. M. A. **127**:307 (Feb. 10) 1945.

Kully discusses in some detail the action of the vasoconstrictor compounds. Tabulation reveals that there are nationally distributed at least 240 such compounds in the form of drops, sprays, inhalants and ointments.

These drugs are adrenergic or sympathomimetic in action. The great question of secondary vasodilatation is fully discussed. Among other points concerning the latter is the one that the fatigue factor as a cause of secondary vasodilatation may be based on exhaustion of the sympathin-constricting factor or may be a physiologic reaction to overstimulation of the vasopressor mechanism, and that the clinical fact remains that persistent vasoconstriction results in secondary dilatation. Another point well brought out is the following: "Individuals vary in their susceptibility to secondary reactions, but no one is completely immune. In many years of observation the author has not seen a single patient who used any of these drugs to excess and remained free from the typical after-congestion."

The author summarizes as follows: 1. A reevaluation of the increased use of the nasal vasoconstrictor medication is indicated. 2. The primary vasoconstricting effect

of sympathomimetic drugs is usually followed by secondary vasodilatation. 3. This secondary vasodilatation is influenced mainly by the type and the amount of the drug employed and the sensitivity of the individual vasomotor mechanism. 4. The addition of antiseptics, particularly solutions of sulfathiazole, to vasoconstrictor drugs increases the irritant properties without compensatory therapeutic benefits. 5. Judicious use of vasoconstrictive medications is indicated in surgical, manipulative and displacement procedures and in some acute nasal infections, notably acute sinusitis. 6. The indiscriminate use of this medication in acute rhinitis lengthens the course of infection and increases the incidence of sinus and otitic complications. 7. Vasoconstrictor drugs may of themselves produce a type of vasomotor rhinitis indistinguishable from that due to allergy. Vasomotor rhinitis, allergic in origin, is made more severe by constricting medication. 8. The use of vasoconstrictor drugs in chronic obstructive pathologic conditions adds the factor of secondary congestion to the obstruction already present.

DISCUSSION

DR. LAWRENCE R. BOIES: I use mild vasoconstrictors in the acute phase of rhinitis only to make the patient more comfortable and not with the idea that I am effecting a cure by this medication. Displacement therapy as originated by Proetz has been a useful treatment in the subacute phase of the infection. I avoid its use in the acute stage. The average layman who medicates for nasal congestion because of the advice he has had over the radio is apt not to have an infection at all but rather a vasomotor state related to some dietary indiscretion, chilling of the body surface or excessive fatigue.

DR. O. E. VAN ALYEA: I believe that vasoconstricting nose drops are of little value in the early stages of engorgement of tissues except as a temporary expedient in lessening the discomfort of an acute cold of the head, and that in the states of chronic sinusitis they are of no value except as vehicles of displacement therapy. Dr. Kully rightly questions the feasibility of shrinking swollen membranes which are merely undergoing a normal physiologic response to disease.

GORDON, Philadelphia.

HEREDITARY FAMILIAL TELANGIECTASIS WITH EPISTAXIS AND MIGRAINE. A. M. G. CAMPBELL, Lancet **2**:502 (Oct. 14) 1944.

Campbell reports the case of a young man with telangiectasis whose mother and maternal aunt and grandmother also had the condition. He also had migraine, which preceded the attacks of bleeding from the nasal nevi. The bleeding, in turn, relieved the migrainous attacks. No focal signs pointed to involvement of the central nervous system. The condition had not seriously affected the longevity of the family.

McCARTER, Boston.
[ARCH. NEUROL. & PSYCHIAT.]

Miscellaneous

VITAMINS AND THE EYE, EAR, NOSE AND THROAT. ISAAC H. JONES, HAROLD S. MUCKLESTON, EUGENE R. LEWIS and GILBERT ROY OWEN, Laryngoscope **54**:628 (Nov.) 1944.

The problem of the value of vitamins is a complex one. Widespread advertising increases the difficulty for the layman.

Severe vitamin deficiency is easily discovered; deficiency is not. The tissues that are most easily served are those of the eye, the ear, the nose, the t and the skin, and it is in these that one can often the first sign of a deficiency. Each germ layer certain vitamins—a fact which should be kept in and which will help simplify the vitamin problem. authors call this "the embryologic approach." No important to the health of the tissues are the materials: the protein, the carbohydrate, the fat minerals and the water. The endocrine glands also be considered.

Many ocular lesions are caused by abnormally intake of vitamin A. A case is given in which dia resulted from overindulgence in vitamin A. Precan ous oral lesions, as well as many others, may be result of low intake of vitamin B. Various experim are mentioned in this connection.

The other vitamins are similarly discussed.

HITSCHLER, Philadelphi

HEMATOLOGY. JOHN J. SHEA, Laryngoscope **54** (Dec.) 1944.

In reviewing recent work in hematology, Shea n that most work has been done on the Rh factor. S of this has resulted in a reduction of the numbe severe reactions following transfusion.

Preparations of thrombin are being prepared for control of surface bleeding. They are particularly cated in bleeding from the adenoid region.

Red blood cell transfusions were found by Alt u helpful after severe hemorrhages. His method is br noted.

Heparin has been used successfully in combi thrombosis of the cavernous sinus. It is given in venously and continuously, for its action is trans The dose is determined by the clotting time. Link his associates have isolated another compound, methylenebis (4-hydroxy-coumarin), which also anticoagulant powers. This drug prevents the forma of thrombin, is administered orally and has a prolo action. However, it is not yet commercially avail

Oral and tonsillar manifestations of leukemia mentioned. New cases of agranulocytosis following use of the sulfonamide drugs have been reported. O aspects of agranulocytosis are discussed, also Hodg disease and pernicious anemia.

HITSCHLER, Philadelphi

SURGICAL TREATMENT FOR DYSFUNCTION OF THE T POROMANDIBULAR JOINT. ROBERT THORNTON P CIVAL, New York State J. Med. **45**:186 (Jan. 1945.

Percival reports 6 cases of "dysfunction" (pain snapping) of the temporomandibular joint. All the tients had been treated by injections into the joint, thermy, chin bandaging, manipulations, exodontia other measures without relief. The author reports forms of pathology"—first, recurring subluxation to shallowness of the condylar fossa, in which the dyle rides forward over the tubercle; second, "a rangement of the interarticular fibrocartilage." capsule is relaxed in all cases. The symptoms snapping when the patient opens the mouth, pain in temporal region of the ear, and noise which may a him from sleep. Operation is performed with the pa

r the influence of a local anesthetic with epinephrine ochloride. The latter is important because of the vascularity of the region. A vertical 4 inch (10 incision is made over the joint, the fascia is ex-d, the auriculotemporal nerve and the blood vessels retracted, the zygomatic fascia is incised, the inter-cartilage is explored and removed, and its place ken by a flap of fascia which is turned into the and sutured. In type I, a "shelf" is made after manner of that procedure in operations on the hips genital dislocations). This prevents overriding of condyle and displacement of the mandible. Transient lysis of the forehead or the face may result from e injuries, but it clears up in about three weeks. d nutriment is fed through a tube until the jaw can pened, usually in a week or so. No retaining splint bandage is applied. The 6 cases are detailed, but accompanying pictures, photographs and line draw-are not very satisfactory in helping one to under-d the text.

VOORHEES, New York.

THE SPECIFIC MEANING OF CERTAIN TERMS INDICATING DIFFERING DEGREES OF FREQUENCY. RAY H. SIMPSON, Quart. J. Speech **10**:328, 1944.

A questionnaire was sent to 335 high school and college students asking them to rate statistically what "almost," "always," "about as often," "frequently" and other such vague expressions of time mean. Such terms as "almost never" had reasonably reliable or consistent meaning, whereas other expressions, such as "frequently," had extremely variable significance. The language is apparently in need of new words to qualify occurrences which come at short intervals of time.

PALMER, Wichita, Kan.

News and Comment

The meeting of the American Academy of Ophthalmology and Otolaryngology which was to be held Oct. 7-11, 1945 has been canceled.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

ELMER W. HAGENS, *President*

WALTER H. THEOBALD, *Secretary*

Regular Monthly Meeting, Nov. 6, 1944

Injuries of the Internal Ear. Presented by DR. WILLIAM E. GROVE.

Practice of Otolaryngology in China in Peace and in War. Presented by DR. A. M. DUNLAP, visiting clinical professor in otolaryngology, University of Chicago.

Dr. Dunlap spoke informally of his experiences as an otolaryngologist in China, which covered a period of something over thirty years, ending with his repatriation on the *Gripsholm* in December 1943. During this time China had been in and out of civil war and finally, in 1937, had been invaded by the Japanese, and this war is still continuing.

Dr. Dunlap had gone to China in the first instance with the Harvard Medical School of China, an organization sponsored by, but without any organic affiliation with, Harvard University Medical School. Experiences with the establishment of the first otolaryngologic clinic in St. Luke's Hospital of Shanghai were related and the various diseases and conditions met with set forth. There were periods in which the hospital devoted a great deal of its service to the treatment of wounded soldiers in and around Shanghai.

In Shanghai between 1911 and 1916 acute hemolytic streptococcus infections and acute mastoiditis were rare. Later these became prevalent in Peiping as complications of scarlet fever. A colleague of the speaker working in Chengtu, West China, had said that at that time there were no streptococcic infections of the mastoid process in his area. But this same colleague in later years said that, following the coming of the airplane to West China, there were a fair number of such infections. The airplane had reduced travel time from six weeks to five hours.

In 1918 the speaker moved to Peiping, where a new clinic was established in connection with the Rockefeller Foundation Hospital and the Peking Medical College, and this clinic was devoted entirely to patients with diseases of the nose, throat and ears. Again, it was the first of its kind to be established in China.

During this period an excessive number of acutely diseased ears were seen. Foreign bodies also were in evidence, the most common perhaps being the date seed, which in North China is extremely sharp on each end and frequently lodges in the upper part of the esophagus.

In the early twenties the first experiments were done on ephedrine. Ephedrine comes from a Chinese herb (ma huang) used in connection with the treatment of bronchitis and had been noted for many years as being effective in certain cases. The actual first administration of ephedrine in the clinic was done by a woman doctor assistant—Dr. Alice Cook—and the first applications were made with 5 and 10 per cent solutions, concentrations which were later found to be unnecessary. After experimentation on dogs, 1 per cent proved to be adequate.

Cancer of the esophagus was found to be extremely prevalent in North China, possibly due to excessive use of a strong native wine. Carcinoma of the nasopharynx was frequent but not as prevalent as in the southern part of China.

In 1931 the speaker returned to private practice in Shanghai and served as clinical professor of otolaryngology in St. Johns University Medical School. During this period the Japanese war began. Experiences were related from the start of the war in 1937 to the declaration of war against the United States by the Japanese on Dec. 7, 1941. Although the Japanese were completely in control of Shanghai, foreign doctors were pretty much alone while the business men of Shanghai were being systematically eliminated. Finally, how pressure from "higher-ups" compelled local authorities to close the offices of all foreign doctors, and all doctors were interned along with other civilians in Shanghai.

ELMER W. HAGENS, *President*

WALTER H. THEOBALD, *Secretary*

Regular Monthly Meeting, Dec. 4, 1944

Nutritional Aspects of Resistance to Infection. Presented by DR. PAUL H. CANNON, of the Department of Pathology of the University of Chicago (by invitation).

(Dr. Cannon requested that no part of the paper or the discussion be printed, in view of the fact that the information has not been released by the Quartermaster General.)

(The discussion was carried on by Drs. Nolan, Theobald, Galloway, Ballenger, Mundt and Cannon.)

Massive Pharyngeal Hemorrhages: Report of a Case. Presented by DR. GEORGE H. WOODRUFF.

This case of serious pharyngeal infection in which three massive hemorrhages occurred was not seen until the suppurative process had run its course; the impression was that the process was in the peritonsillar and parapharyngeal space. The patient was examined four weeks after the onset of symptoms, during which time he had been under the care of other physicians with a history of sore throat with rapid swelling, pain and marked tenderness on the right side; he had been hospitalized for one week. Because of the history of three massive hemorrhages within one week and because it was felt that there was no assurance that another might not occur and prove fatal, immediate operation was advised.

An incision was made along the anterior border of the sternocleidomastoid muscle and the carotid sheath was exposed by blunt dissection, which was continued upward until the parapharyngeal space was fairly well exposed. Considerable old clotted blood was removed from this area. The upper portion of the space was gently explored with the index finger, and a cop

bleeding started, which appeared to originate at the level of the tonsil, although the bleeding was not identified. The hemorrhage was checked ital pressure while the common carotid artery was with two silk sutures. A small rubber tissue was inserted, and the muscle and fascial wounds closed and the skin approximated.

alescence was uneventful, and the patient left spital thirty-six days after the onset of illness n days after the operation.

eviewing this case it appears that many physicians realize the possibility of serious hemorrhage bscesses of the pharyngeal region. There was ntly considerable reluctance to believe that the nt hemorrhages came from the peripharyngeal ation, inasmuch as roentgen examination of the was carried out in the search for the site of rhage. The train of circumstances in this case and during operation justified the procedure of of the common carotid artery, and this is still cedure of choice in the great majority of cases ing the picture of massive pharyngeal hemor-

DISCUSSION

MAURICE F. SNITMAN: Generally, thrombosis of el is secondary to an injury of its wall caused ection or trauma. When the injury is due to n there is slowing of the blood stream and a in the blood, a natural protective response to e sealing of the injured wall. Platelets are first own with an admixture of white blood cells, this g a rather firm tenacious coating. Because of ower circulation in the veins, they are more fre- thrombosed than are arteries.

difficult to determine whether pharyngeal hemor- ccurs from rupture of the internal carotid artery n rupture of one of the pharyngeal branches of ernal carotid artery. A small sudden hemorrhage e internal carotid artery is possible, since the may be of small size. Salinger and Pearlman ated that most hemorrhages are from the internal artery, while Kerwin expressed the belief that uptures occur in the pharyngeal branches of the l maxillary artery. The determination of the involved is extremely difficult during a surgical re involving infected tissues of the neck.

Army has prepared a film for the medical per- on the importance of the so-called anterior of the sixth cervical vertebra. In practically ections one finds that the common carotid artery in the vicinity of, or just over, the anterior of this tubercle, so that when sudden hemorrhage lace pressure should be applied to this region. asy to feel that artery in the neck because at nt it is most superficial.

question arises why after ligation of the com- rotid artery there is no hemorrhage. One would bleeding to continue because of the connection artery with the circle of Willis and with the rtebral arteries. It has been shown that after g of the internal carotid artery there is a reduc- almost half the blood flow in the artery, and n readily see why this would produce good sis. Carmack stated that fatal hemorrhage from otid artery must be more prevalent than one can e from the literature. It would be natural that ses are not reported.

Woodruff is to be complimented on the success- agement of his case.

R. W. KERWIN: I became interested in this while studying under Professor Wessely at the Neumann Clinic in Vienna, Austria. He taught me to section the vessel. In looking over the literature, I found a great deal of material on the subject. Many cases did not terminate successfully as did Dr. Woodruff's. Horsley Jr. stressed the fact that besides contracting, the artery retracts, and when the vessel is simply ligated, allowance is not made for this second factor of retraction and buttonholing of the vessel is likely to happen. Against that we have the experience of many men at Cook County Hospital, who have simply ligated vessels without sectioning and have obtained apparently satisfactory results. In a few selected cases I sectioned vessels between two transfixed ligatures, on the advice of Professor Wessely. There was no immediate or delayed bleeding from the ligated ends of the vessels. Then I did a section of the common carotid artery itself, which took a lot of courage. There was no postoperative bleeding and fortunately none of the cerebral sequelae which supposedly may be expected to follow such a procedure. As a result of this experience I do not hesitate to section an artery of any size, rather than to trust to simple ligation.

DR. THOMAS C. GALLOWAY: I think I reported one of the earlier cases of erosion of the carotid artery. In this case an assistant could not at all control hemorrhage by compression against the vertebra. It is a practical point that one should first isolate the common carotid artery and surround it by a ligature. In profuse and sudden hemorrhage in the pharynx it must be assumed that bleeding is from the internal carotid artery itself, since it has no cervical branches except that the ascending pharyngeal artery may arise at the bifurcation. One must bear in mind that unusual bleeding may come from the internal jugular vein. It may be active and persistent, and although it can be temporarily controlled by packing, if the vein cannot be ligated in the neck above the bleeding, it may require exposure of the sigmoid sinus through the mastoid process and packing down to the bulb.

DR. GEORGE H. WOODRUFF: I was glad to have Dr. Snitman's comment on thrombosis of the veins. The internal maxillary artery seems to be the vessel involved most frequently in post-tonsillectomy hemorrhage. However, in deep abscess of the neck, all statistics point to the internal carotid artery being the usual source of hemorrhage. I purposely did not touch on bleeding after tonsillectomy, although that subject is important.

In reply to Dr. Galloway's comment: As I understand it, the internal carotid artery lies in the posterior compartment of the parapharyngeal space. It does not run through the pharyngomaxillary space which is farther anterior; in fact this term is synonymous with "anterior compartment of the parapharyngeal space."

ELMER W. HAGENS, *President*

WALTER H. THEOBALD, *Secretary*

Regular Monthly Meeting, Jan. 8, 1945

Alterations in the Brain Due to Asphyxiation. Presented by DR. WILLIAM F. WINDLE, professor of neurology, Northwestern University Medical School (by invitation).

Guinea pigs were asphyxiated and resuscitated at birth. The brains of these and of normal litter mate controls were sectioned serially and stained by a method permitting accurate histologic comparison.

Hemorrhages occurred in the brains of all the resuscitated animals three hours to five days after resuscitation, but in none that was killed by asphyxia. Edema appeared to be present between eight hours and four days after resuscitation. Hemorrhage and edema apparently were not primary causes of neuronal damage. Changes in nerve cells, including peripheral vacuolation and chromatolysis, occurred in all specimens between one and one-half hours and twenty-one days after birth. Marked cytologic lesions were often circumscribed. The cerebellum and the corpus striatum were not severely affected, but the thalamus, the cerebral cortex, the tegmentum and the spinal cord were often badly damaged. A transient proliferation of microglia took place at two to twenty-one days. Generalized or regional atrophy followed destruction of neurons in two thirds of the severely asphyxiated and half of the mildly asphyxiated animals.

It was concluded that experimental asphyxiation followed by successful resuscitation of guinea pigs at birth produced neuropathologic changes of variable degrees of severity in all specimens studied one and one-half hours to three weeks after birth, and produced detectable permanent structural changes in more than half of those allowed to live for more than three weeks.

DISCUSSION

DR. ANDREW C. IVY: The work Dr. Windle has been doing is of obvious interest to physiologists and I believe also to any one called on to relieve asphyxia or tracheal obstruction, or who has had an unfortunate anesthetic accident. My co-workers and I have frequently had occasion to operate in the thorax, and in 1 of 15 dogs, on sectioning the vagi and the thoracic sympathetic trunks, the respiration and the heart action have stopped. They do not recover unless something is done. If something is done, one can resuscitate every one of these animals. The best procedure in these —I can speak with experience because I have had 20 such cases—is to inject 0.5 mg. of epinephrine hydrochloride and 1 mg. of atropine sulfate into the ventricle and apply massage to the heart. When the blood pressure is brought to normal in five minutes, respiration will return along with the blood pressure, and the dog will regain consciousness. But if the blood pressure is not brought back to normal in ten minutes, the dog will never regain consciousness, although one can frequently resuscitate the respiratory and the vasomotor centers in the dog after ten minutes. This illustrates how sensitive the cerebrum of the dog is to anoxia. The medullary centers are much more resistant than those of the cerebrum.

The hemorrhage seen in the brain substance in asphyxial death has interested me from the point of view of the explanation. I would like to know how Dr. Windle explains the hemorrhages he has observed. In asphyxia the blood pressure rises in the initial stage; this rise along with asphyxial convulsions may cause a mechanical rupture of blood vessels; this is the only explanation that occurs to me. Associated with obstructive asphyxia in the dog and frequently with that in the human being, we have observed petechial hemorrhages beneath the pleura. We have explained this as being due to mechanical pressure leading to rupture of capillaries. So far as I know this is the only explanation applicable to the lung. If Dr. Windle's guinea pigs did not show asphyxial struggles, we should have to search for another explanation.

Of course when there is a hemorrhage and actual destruction of brain cells in the primary motor and primary sensory areas, one can understand w animal or the human being is unable to learn, the basis of recent studies of the function of the area of the cortex, the animal or the human should be able to get along when deprived of number of brain cells located in association ar wonder whether Dr. Windle ascribes the disturb learning in the guinea pig to the lesion of the p sensory and motor areas of the cortex or to turbance of the association areas of the cortex.

We find that the young animal is much more t to asphyxia and anoxia than the adult. On th of our observations that is true. But does that enough? We attempt first to resuscitate the tion and the respiration, in order to obtain survi then we look for a return of consciousness, h general rule we do not look further. It may b took adults and examined their ability to perfor to learn, and then subjected them to asphyx might find that the adult as well as the young is sensitive to asphyxia. It may be that asphy the adult will interfere with learning. At pres cannot conclude that the cerebrum of the young is more resistant to asphyxia than the cerebrum adult, because we have not measured the adu there any evidence to show that the vital cen the medulla of the newborn guinea pig will wi complete ischemia longer than the medullary of the adult guinea pig? In the adult dog the is twenty, thirty, thirty-five minutes of ischemia. not observed the medullary centers of puppies standing asphyxia longer than thirty minutes.

In the adult man it is interesting to know that the oxygen saturation of the hemoglobin of the is reduced to 80 to 85 per cent, impairment o function occurs; if the saturation of the blood duced to 66 per cent, the majority of persons w consciousness. What does that mean? It mean 5 of every 15 Gm. of hemoglobin in the blood is r hemoglobin; this is the condition normally pres the venous circulation; in other words, the hemo returning to the right side of the heart is approxi 66 per cent saturated. That is, an adult man ma consciousness when the arteries contain that amo reduced hemoglobin which is normally present in blood. This is a good way to remember the va oxygen in the arterial blood required to maintai sciousness.

Dr. Windle's observations emphasize the impo of relieving a tracheal obstruction as early as p not only to save life but to prevent irreversible d of cortical nerve cells. In the case of anesthetic dents, speed is indicated not only to save the the patient but also to preserve his normal activity.

DR. THOMAS C. GALLOWAY: The clinical impli of this work are great. Otolaryngologists hav sidered anoxia rather abstractly as it occurs in clinical conditions and have wondered how mu picture was due to anoxia. I know no work com to this as a clearcut demonstration of what anoxi to the brain tissues. The importance of anoxia i bar poliomyelitis, in tracheobronchitis, in anesthe carbon monoxide poisoning, in flame and gas i and many other conditions is, I am sure, fre not appreciated.

Recently, at a symposium on poliomyelitis one pathologists gave some beautiful demonstrations idea of the histopathologic nature of the disease. photomicrographs were much like those Dr. W

and I think much of his pictures might be due
ia. In clinical descriptions of this disease many
ms ascribed to virus infection, such as depression,
tation, restlessness and even coma, may change
ickly when the airway is cleared and seem al-
rtainly due to anoxia.
ia can so quickly become irreversible that what
s must be done quickly. Respiratory obstruction
e relieved before permanent damage has been
nd the margin of safety may be slight. If the
ffers so quickly from anoxia, other organs must
damaged, especially the heart and the respiratory
s.

PAUL HOLINGER: Certainly many clinical phe-
have been explained by this most excellent work
r. Windle has done and has shown today. I
like to ask him whether he has had any experi-
producing types of anoxemia similar to those
to be produced by overdosage of barbiturates.
sedatives are often used in excessive amounts,
vere respiratory obstruction results. It would
to me that their use or abuse in obstetrics and
atrics could lead to the conditions demonstrated

ELMER W. HAGENS: Many times it is important
de whether the difficulty is due to a central or
eripheral lesion, and whether it is possible to
e them. We are also interested in whether to
ygen or carbon dioxide, or a combination. I
like to ask about artificial respiration. It seems
me patients recover more rapidly by a com-
n of the administration of oxygen with active
ents stimulating respiration.

WILLIAM F. WINDLE: I have no really good
to the question why hemorrhages occur. In
servations presented it appeared that hemorrhage
t occur until after resuscitation was effected.
ies were made on a few animals which were not
tated but asphyxiated to death, and the brain
tudied histologically, but we found no hemor-
. In some of those that lived but a short time
nd no hemorrhages. In all those that were re-
ted and lived three hours or more we did find
rhages. So it seems that the hemorrhages came
fter resuscitation. It is simply guessed that after
tation, with a rise in blood pressure and perhaps
panying weakening of the capillary walls—though
do not know—there occurred a leakage of blood.
not think the hemorrhage occurred because of
ruggle during asphyxiation. You saw it in the
nd it was not marked.

ANDREW C. IVY: It has been shown that asphyxia
es the permeability of the capillaries to protein,
cording to my information, it has not been shown
sphyxia permits the red cells to pass out by dia-
. It is possible that asphyxia might alter the
ries of the brain and the lungs to such an extent
emorrhage per diapedesis results.
are in the process of investigating various
s which have been recommended for resuscitation.
as my interpretation of the literature is con-
, it is rational to use an oxygen–carbon dioxide
e, i. e., 5 to 10 per cent carbon dioxide and 95
per cent oxygen, in the early treatment of carbon
ide poisoning, because the evidence suggests that
an oxygen–carbon dioxide mixture is used the
monoxide is cleared from the blood more rapidly
when 100 per cent oxygen is used. The only
in my opinion for the use of carbon dioxide is
t stimulates the respiratory centers and offsets the effects of acarbia when this is due to hyperventilation; but one cannot always tell when the center is depressed in such a way that it is advisable to stimulate it with oxygen.

I cannot with conviction based on evidence tell you in which conditions other than carbon monoxide poisoning it will be beneficial to administer an oxygen–carbon dioxide mixture. There is one point that should be kept in mind. If you should breathe a mixture of 5 per cent carbon dioxide and 95 per cent oxygen, you would be tired out in thirty minutes as a result of extra respiratory effort, and you could perform but little work while breathing the mixture. One can breathe 3 per cent carbon dioxide and 97 per cent oxygen for an hour or more without becoming tired. So, if one has a patient already weak and exhausted and gives 5 per cent carbon dioxide and 95 per cent oxygen for longer than a few minutes, one adds to the exhaustion. I have taught for more than five years that if an oxygen–carbon dioxide mixture is used to clear the lungs after administration of an anesthetic it should not be used longer than five to ten minutes. If any one is skeptical of the truth of this point, I suggest that he breathe a mixture of 5 or 7 per cent carbon dioxide and 95 to 93 per cent oxygen; 3 per cent carbon dioxide for longer periods and 5 or 7 per cent for short periods may be beneficial in certain states of "shock," but in my opinion there is not enough evidence in the literature to be dogmatic about it. There is a need of well controlled evidence from the laboratory and the clinic. There is a paucity of such evidence at present.

DR. WILLIAM F. WINDLE: A number of observations have been reported with regard to the survival time. It has been shown in rabbits and rats, and my coworkers and I have shown it in the cat, that the survival time—the time during which an animal will live while in an atmosphere of nitrogen or drowning under water—is greater for the newborn or the fetus than for the adult. In an atmosphere of nitrogen an adult rat will die in two or three minutes whereas a newborn rat will live for nearly an hour. In the case of the newborn cat the survival time appears to be about thirty minutes. For the guinea pig it is less; twenty or twenty-two minutes is the maximum.

Dr. Galloway mentioned damage of other organs; we did find hemorrhage in other organs, notably the lung and some of the abdominal organs, even on the wall of the stomach and in the liver.

Dr. Hagens asked whether to use oxygen or carbon dioxide. In the case of the newborn I think one is justified in using any means at hand; the quickest are the best. Do not wait for oxygen or a drug. The main thing is to get air in, by mouth to mouth breathing if necessary, in the case of an infant in dire distress.

At one time we felt there was a good deal of justification for the use of carbon dioxide with oxygen, and we did some experiments in which the pregnant cat was given pentobarbital sodium in large amounts, and the fetuses resuscitated afterward. We had little success with carbon dioxide and oxygen, but oxygen alone gave better results. The present experiments were done without anesthesia, except local. In some experiments we asphyxiated two fetuses and resuscitated one with carbon dioxide–oxygen mixtures and one with oxygen alone. It did not seem to make much difference.

There were parts of the brain in which we found no hemorrhages in any animal; none was observed in the cerebellum or the corpus striatum. The incidence of hemorrhage was extremely variable. The thalamus was the most frequent site.

The Therapeutic Value of Iodized Poppyseed Oil 40 per Cent in Sinus Infection. Pesented by Dr. Hans Brunner.

Iodized poppyseed oil 40 per cent usually does not exert any influence on the nasal mucosa, nor does it cause permanent paralysis of ciliary action.

If introduced into the maxillary sinus, the oil goes to the bottom if a sufficient amount is used; therefore, it must be heavier than the exudate in the sinus.

Conclusions concerning the thickness of the mucosa should not be drawn from roentgenograms taken immediately after the injection of oil unless a proper amount of oil was introduced.

Filling by displacement usually does not permit the introduction of an adequate amount of oil into the maxillary sinus.

If iodized oil offers any therapeutic effect, this consists only in protecting the membrane against the action of the exudate and in breaking the vicious circle of exudate and membrane.

In chronic infections of the maxillary sinus there are two types of emptying; in the first the emptying is definitely delayed, but the emptying time approaches normal if the chronic infection begins to subside. In the second type the emptying time is normal or hastened.

In the first type, emptying is chiefly through ciliary action; in the second, by pressure of exudation.

A thorough tampon effect by the oil can be achieved only in the first type, but it seems that iodized oil hastens cure in the second type also.

DISCUSSION

Dr. T. J. Wachowski: So far as roentgenologists are concerned, they have to depend solely on objective findings, and they are subject to differences of opinion as to the interpretation of these. They do not take into consideration subjective findings or symptoms and many objective findings, such as drainage and pus, which color the interpretation of the clinician. They do not have the benefit of that. It might be of interest to say that when my colleagues and I did some work on conscientious objectors we found in a high percentage what we would call evidence of diseased sinuses. Most had no symptoms or complained only of postnasal drip, which one would expect in this climate. What roentgenologists might say represents an active pathologic process and what you might say in reading the same film might vary considerably.

One thing Dr. Brunner showed is the oil floating in the exudate. Roentgenologists see the same thing in the oviduct; the oil spills out of the tube and you might think it was patent. You will see that in twenty-four hours the oil is still in the same position. Certainly it is presumptuous to say that the oil should reach the bottom in a few minutes. Most oil will go down through pus, and I think Dr. Van Alyea has some interesting things to show in that respect.

The question of a defect between the rim of the antrum and the oil comes up. I wonder if that space is not due to thickened membrane. I realize that a membrane can get very thick, and certainly in acute infections one sees this due to edema. I wonder whether part of the decrease of that thickening is not due to the fact that Dr. Brunner has established drainage and whether that has not had a therapeutic effect. I know how rapidly such regression can occur.

I should like to show slides representing 2 patients:

Patient 1 had an oil filling showing marked hyperplasia of the membrane of the antrum. No further oil was instilled, but drainage was maintained for three months. A second oil filling at that time showed an approximately normal lining membrane. Such are not unusual and can be attributed almost to the drainage which is established.

Patient 2 had an oil filling showing marked plasia of the lining membrane of the antrum. Fo this procedure oil drained for a few days, but t drainage stopped. He suffered severe pain for three days, which necessitated use of a narcotic lowing that, the symptoms regressed, and he h followed for nine months by roentgen films, which a persistence of the thick membrane and a la siduum of oil in the antrum. From the sta of the patient, he is well; therefore he has had done to the sinus. Whether he is a patient phlegmatic and refuses to admit that he has a pa condition or whether it is possible to have the ance of marked infection in the sinus without toms, I cannot say. It would seem that the oi without the benefit of drainage, has not effe orthodox cure. It is obvious that the sinus emptying and one would expect severe symptom the patient disclaims them. It is possible th iodized oil has something to do with this situation. Dr. Van Alyea is familiar with the ca I should like him to explain the confusing pict

Dr. O. E. Van Alyea: Dr. Brunner has pr some very interesting angles of the subject of oil in sinus therapy. Dr. Goodyear back in the twenties noted improvement in the sinuses h studying while using oil as a diagnostic aid. Sin he has kept the subject alive with many artic most recent paper being presented at the 1940 m of the American Medical Association.

In discussion of that paper, Dr. Arthur Proetz, Louis, brought out the idea that the oil may se a protective membrane for the mucosa of the sinu noted that when oil was poured into a test tub taining a watery solution it settled to the b During the past few days I have repeated this e ment, using samples of exudate obtained from in sinuses. Various types of exudate were collecte in all cases the oil was soon seen at the bottom tube. In the watery type of secretion, that kno the pea soup variety, the oil passed through i ately. In some of the thick, heavy exudates, th of penetration was approximately thirty minutes.

The value of oil as a therapeutic agent is the s under discussion. Dr. Brunner has followed t suggestion of Dr. Proetz that the oil may act protective tampon. I quite agree with this. The of such protection is more clearly appreciated the nature of the inflammatory exudate is under The polymorphonuclear leukocytes present in numbers contain powerful proteolytic enzymes, th pose of which is to dissolve phagocytosed bacteri a stagnant exudate such as may be commonly fou infected maxillary or sphenoid cavities, the pus disintegrate. Their content of enzyme is thus re and acts as an irritant to any tissue with which i come in contact. In poorly draining cavities, the effect of this enzyme may well account for a pro tion of infection. If this oil displaces that enzym moving the enzyme from contact with the mucosa oil in truth acts as a tampon, one which may contribute to the elimination of a persistent infe It is important, however, that the exudate have a c to get out of the sinus. To depend entirely o instillation of a small quantity of oil, as advocate Goodyear, is asking a great deal of a single proce With infection of a sinus there is inadequate drai proper management, therefore, includes all nece

s to correct defects of drainage. This may re-ertain minor surgical procedures and careful of the patient's general condition, including a or allergy. An occasional lavage of the involved is helpful not only to remove accumulated secre-t to throw light on the progress of the case. rrigation is harmful, as stressed by Dr. Brunner. ite true that infection may be kept in an active daily irrigations. I have found that infections es tend to clear up more rapidly when an in-of one week is allowed between treatments, this consists of some minor surgical corrective or merely lavage of the sinus.

SAMUEL SALINGER: Dr. Brunner has a way of a subject appear extremely simple and at the me complicated. When one speaks of chronic , what kind of sinusitis is one talking about? nize three types: a sinus in which the mucous ne is thickened but in which I rarely find any n, another type in which there is a profuse dis-and a third type characterized by the formation pi and thick mucoid or mucopurulent secretion. t conceive of a therapeutic procedure that is applicable to all three. My own experience has nd I use iodized oil a good deal for diagnosis, cases in which the oil has failed to be eliminated e sinus within a couple of weeks, that sinus get well without surgical treatment. I have the sinus three to six months later and found f that oil encysted and inspissated, and remain-foreign body. So it is difficult for me to accept pon theory. Despite the fact that patients have y felt better and the fact that I have noted a ion of secretion, I cannot say that I have found be cured if they had an irreducible infection in cous membrane. I think if one is evaluating tic procedures one should be more specific about e of pathologic condition one is discussing.

ANDREW C. IVY: In regard to the patient in the iodized oil remained in the sinus for a long did Dr. Brunner introduce a second quantity to n how long it would remain? If the patient's ere normal, as he assumed, a second injection of should have been followed in a few days by dis-of the oil.

WALTER H. THEOBALD: Concerning the func-behavior of the maxillary sinus, there is one Dr. Brunner did not mention. He stated that ized oil does not sink to the bottom in some ut floats on top of the exudate. These test tubes t going to the bottom, however. The simplest re is to inject the oil after irrigating the sinus, eliminating all the exudate. In 1933 my asso-ciates and I made some investigations with radiopaque oil, injecting it into the antrum while keeping the head in a lateral position and taking films, lateral and anteroposterior, with the head in the same position. This kept the oil in situ and revealed complete filling of the antral cavity.

In 1936 King presented a paper on postoperative ciliary function within the antrum. In like manner I studied the ciliary activity of a maxillary sinus known to be normal and noted the rapidity with which a radiopaque substance is removed from the antrum. For this purpose we used barium sulfate as a radiopaque substance, with the idea that it might provide a more nearly normal response from the cilia. Therefore, 1 cc. of a heavy mixture of barium sulfate in water was injected into the antrum through the natural opening, without the use of cocaine or other medication. Study of the films revealed migration in the direction of the natural opening within twenty-five minutes. Further exposures on succeeding hours and days showed that it required eight days to empty the antrum completely.

In another case in which a radical operation had been performed three and one-half years previously, this functional test revealed a small diminution of barium sulfate after two and a half days. Nine days later roentgen examination showed only a slight decrease in the amount of barium sulfate. From this observation it would appear that the ciliary function of the mucosa of the antrum was absent. Despite this fact there had been no recurrence of infection in this case.

DR. HANS BRUNNER: In answer to Dr. Ivy, in the case to which he referred, no additional oil was introduced during the nine weeks of observation.

I believe Dr. Wachowsky misunderstood me. I considered the large space between the floor of the sinus and the oil, as it appeared in the second case shown, as swollen mucosa and not as exudate. But I emphasized that this swollen mucosa on the floor of the sinus together with the exudate is capable of pushing the oil toward the natural ostium and thus of expelling it from the sinus. Owing to this mechanism, the emptying time in chronic sinus infections is normal or shortened; in chronic sinus infections in which emptying is achieved by ciliary action it is delayed. This was the principal finding in my report.

I do not know that there are different clinical types of chronic sinus infections if the specific infections are put aside. The sinus mucosa may react in a different manner to chronic infection, but such differences are histologic and not clinical. Certainly I do not know the rationale of introducing iodized oil into a sinus for therapeutic purposes if the sinus contains only hyperplastic mucosa, with no exudate.

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